

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT				1. CONTRACT ID CODE N/A		PAGE OF PAGES 1 70	
2. AMENDMENT/MODIFICATION NO. 0002		3. EFFECTIVE DATE 11 FEB 2005		4. REQUISITION/PURCHASE REQ. NO. N/A		5. PROJECT NO. (If applicable)	
6. ISSUED BY USACE SACRAMENTO DISTRICT ATTN: CONTRACTING DIVISION 1325 J STREET SACRAMENTO, CALIFORNIA 95814-2922		CODE		7. ADMINISTERED BY (If other than Item 6) SEE ITEM 6		CODE	
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)				(✓)		9A. AMENDMENT OF SOLICITATION NO. W91238-05-B-0002	
				×		9B. DATED (SEE ITEM 11) 28 JAN 2005	
						10A. MODIFICATION OF CONTRACTS/ORDER NO. N/A	
						10B. DATED (SEE ITEM 13) N/A	
CODE		FACILITY CODE					

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(✓)	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
DEER CREEK WASTEWATER TREATMENT PLANT REGULATORY COMPLIANCE IMPROVEMENTS EQUALIZATION SYSTEM
PLACERVILLE, CALIFORNIA

SEE CONTINUATION SHEET

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED

CONTINUATION SHEET

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT
AMENDMENT/MODIFICATION NO. 0002

DEER CREEK WASTEWATER TREATMENT PLANT REGULATORY COMPLIANCE IMPROVEMENTS
EQUALIZATION SYSTEM
PLACERVILLE, CALIFORNIA

2 ENCLS:

- 1) PAGES: SF 1442, 0700, 09903, 16010 AND 16210.
- 2) DRAWING SHEET G-001.

SOLICITATION, OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i>	1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	W91238-05-B-0002	<input checked="checked" type="checkbox"/> SEALED BID (IFB) <input type="checkbox"/> NEGOTIATED (RFP)	-January 28, 2005	1 OF 135

IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO.
	W62N6M43520001	

7. ISSUED BY	CODE	W91238	8. ADDRESS OFFER TO <i>(If Other Than Item 7)</i> CODE	
USACE SACRAMENTO DISTRICT ATTN: CONTRACTING DIVISION 1325 J STREET SACRAMENTO CA 95814-2922			See Item 7	
TEL:	FAX:		TEL:	FAX:

9. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE NO. <i>(Include area code)</i> (NO COLLECT CALLS)
	PATRICIA A CHRISTIE	916-557-5228

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying no., date):*

Spec No. 1453 - El Dorado Irrigation District, Deer Creek Wastewater Treatment Plant, Placerville, El Dorado County, CA - This Procurement is limited to 8(a) contractors registered with SBA District Offices located in the State of California. Description: Construction of a portion of the current Deer Creek Wastewater Treatment Plant Improvement Project to increase recycled water availability by more than 6.3 million gallons annually. Work includes: 1) Refurbishment and modifications to an existing 1 MG Equalization Tank and addition of a second 2.6 MG Equalization Tank. 2) Replacement of the plant generator to handle larger pumping capacities. Estimated price range is between \$5.0M and \$10.0M.

11. The Contractor shall begin performance within 1 calendar days and complete it within 400 calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable. *(See 52.211-10)*

12 A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS?
(If "YES," indicate within how many calendar days after award in Item 12B.)

☒ YES ☐ NO

12B. CALENDAR DAYS

5

13. ADDITIONAL SOLICITATION REQUIREMENTS:

- A. Sealed offers in original and 0 copies to perform the work required are due at the place specified in Item 8 by 01:00 PM *(hour)* local time 01 Mar 2005 *(date)*. If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.
- B. An offer guarantee ☒ is, ☐ is not required.
- C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.
- D. Offers providing less than 60 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

SOLICITATION, OFFER, AND AWARD (Continued)*(Construction, Alteration, or Repair)***OFFER (Must be fully completed by offeror)**

14. NAME AND ADDRESS OF OFFEROR <i>(Include ZIP Code)</i>		15. TELEPHONE NO. <i>(Include area code)</i>
		16. REMITTANCE ADDRESS <i>(Include only if different than Item 14)</i> See Item 14
CODE	FACILITY CODE	

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ calendar days after the date offers are due. *(Insert any number equal to or greater than the minimum requirements stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)*

AMOUNTS	SEE SCHEDULE OF PRICES
---------	------------------------

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS*(The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each)*

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN
OFFER *(Type or print)*

20B. SIGNATURE

20C. OFFER DATE

AWARD (To be completed by Government)

21. ITEMS ACCEPTED:

22. AMOUNT

23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN
(4 copies unless otherwise specified)

ITEM

25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO
☐ 10 U.S.C. 2304(c) ☐ 41 U.S.C. 253(c)

26. ADMINISTERED BY

CODE

27. PAYMENT WILL BE MADE BY:

CODE

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return _____ copies to issuing office.)* Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.

☐ 29. AWARD *(Contractor is not required to sign this document.)*

Your offer on this solicitation, is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN *(Type or print)*

31A. NAME OF CONTRACTING OFFICER *(Type or print)*

30B. SIGNATURE

30C. DATE

TEL:

EMAIL:

31B. UNITED STATES OF AMERICA
BY

31C. AWARD DATE

Contractor indicated in the contract will be considered to be incorrect information within the meaning of the "Suspension of Payment" paragraph of the electronic funds transfer (EFT) clause of this contract.

(2) The Contractor shall not change the name or address for EFT payments or manual payments, as appropriate, in the CCR record to reflect an assignee for the purpose of assignment of claims (see FAR Subpart 32.8, Assignment of Claims). Assignees shall be separately registered in the CCR database. Information provided to the Contractor's CCR record that indicates payments, including those made by EFT, to an ultimate recipient other than that Contractor will be considered to be incorrect information within the meaning of the "Suspension of payment" paragraph of the EFT clause of this contract.

(h) Offerors and Contractors may obtain information on registration and annual confirmation requirements via the internet at <http://www.ccr.gov> or by calling 1-888-227-2423, or 269-961-5757.

(End of clause)

52.209-6 PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT (JUL 1995)

(a) The Government suspends or debar Contractors to protect the Government's interests. The Contractor shall not enter into any subcontract in excess of the \$25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed \$25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principles, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within 1 calendar day after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than **400** calendar days after receipt of the notice to proceed.

The time stated for completion shall include final cleanup of the premises.

SECTION 09903

EPOXY COATING - STEEL RESERVOIR FLOOR GROUTING

PART 1: GENERAL

1.01 DESCRIPTION

This work in this section covers the materials and application of a corrosion-resistant, spray-applied, polymer, monolithic lining for protection of the interior grouted floor of the existing 1.0 million gallon welded steel reservoir as specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 09902: Painting – Steel Reservoir
- B. Section 03361: Steel Reservoir Floor Grouting

1.03 SUBMITTALS

As specified in Section 01330. Submit product data, material safety data sheets, color chips, and National Sanitation Foundation (NSF) Standard NSF 61 compliance data for the coatings. Include mixing instructions, thinning recommendations, percent solids, spread rate, application instructions, application restrictions such as minimum and maximum surface temperatures, dewpoint and relative humidity limitations, unit weight per gallon, drying time, pot life, and safety precautions. Also include manufacturer's voltage requirements for holiday testing.

1.04 PRODUCT DELIVERY, HANDLING, AND STORAGE

- A. Deliver coating material in original sealed containers, marked with the manufacturer's name, product name or number, and lot number. Do not use material until Owner has inspected contents and obtained data from container label.
- B. Protect coating materials from precipitation, excessive heat or cold as specified by manufacturer.
 - 1. Store abrasives used for blast cleaning off the ground, protected from moisture and the elements.

1.05 PROJECT CONDITIONS

- A. Provide instruments to measure air temperature, surface temperature of the steel, and relative humidity. Take and record measurements at the actual location of the work before each workday begins and every 4 hours thereafter or when noticeable weather changes occur.
- B. Temperature of Working Area - Optimum temperature for handling and applying materials is 65-80°F. Store material within the 65° to 80°F range for 48 hours prior to use. At material temperatures below 65°F, the application becomes more difficult and curing is retarded. Above 85°F material-working time is reduced.
- C. The Contractor shall maintain a thermometer in the shade at the project site and shall keep informed of the dewpoint and humidity from the weather bureau.

- D. Environmental conditions may be modified using dehumidification or heating equipment to bring ambient conditions within acceptable limits. When heaters are used, locate heaters outside of the tank with hot air ducted into the tank. Heaters shall be fueled by clean burning fuels.
- E. In cases of dispute concerning film thickness, measurements made with instruments shown to be in calibration with the National Institute of Standards and Technology calibration plates shall take precedence.
- F. Inspection Devices: Until final acceptance of coating and painting, the Contractor shall furnish and make available to the Owner inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint. The Contractor shall also furnish calibration plates certified by the National Institute of Standards and Technology to test the accuracy of the dry film thickness gauge. All inspection devices shall be in good working order.

1.06 CLOSEOUT SUBMITTALS

As specified in Section 01780A. Furnish two 1-quart representative samples of each type of coating for subsequent analysis should premature coating failure occur, and 5 gallons of each type coating for touch-up.

PART 2: PRODUCTS

2.01 EPOXY SYSTEM

- A. The Epoxy system shall be one or more materials that are applied to a surface to provide abrasion and chemical resistance and shall be Sauereisen Sewergard No. 210S system or equal. ***The materials specified herein shall be suitable for application in a wastewater environment such that it shall be impervious to the corrosive underwater environment of wastewater including corrositivity of sulfides and ammonia.***

1.	<u>Properties</u>	<u>Primer Material</u>
	Application time	
	Working Time at 70°F	30 minutes
	Cure Time at 70°F	3 hours
	Components	2 part
	Thickness	5-10 mils
	Bond strength to concrete (ASTM C-478)	Concrete failure
2.	<u>Properties</u>	<u>Epoxy Lining</u>
	Abrasion resistance (ASTM D-4060, Tabor Abrader C-17 wheel, 1,000 gram load, 1,000 cycles)	49 mg. average weight loss
	Application time (ASTM C-306 modified)	
	Working time at 70°F	30 minutes
	Initial set at 70°F	17 hours
	Bond strength to dry or damp concrete manhole (ASTM D-4541)	Concrete failure
	Components	2
	Coefficient of thermal expansion (ASTM C-531)	3.8 x 10 ⁻⁵ / F° (2.1 x 10 ⁻⁵ /C°)
	Compressive strength (C-579)	6,800 psi (478 kg/cm ²)
	Density (ASTM C-905)	77 pcf (1.23 kg/cm ³)

Flexural strength (ASTM C-580)	4,600 psi (323 kg/cm2)
Maximum service temperature	150°F (65°C)
Modulus of elasticity (ASTM C-580)	3.3 x 105 psi (2.3 x 104kg/cm2)
Moisture absorption (ASTM C-413)	0.2%
Shrinkage (ASTM C-531)	0.11%
Tensile strength (ASTM C-307)	2,500 psi (176 kg.cm2)
Thickness	65 mils (1.65 mm)
Elongation	1.27%
Tensile Modulus	42,500 psi (295 kg.cm2)
Fracture toughness	100 in-lb./cu. in

3. <u>Properties</u>	<u>Glaze</u>
Working Time	30 minutes
Cure Time	18 hours @ 70°F
Chemical Service	72 hours @ 70°F
Thickness	15 mils (0.38 mm)

PART 3: EXECUTION

3.01 SURFACE PREPARATION

- A. New Concrete - Concrete should be floated free of sharp edges, ridges or depressions. All structural cracks shall be repaired; voids filled and slopes reestablished (Call Sauereisen for recommended repair procedures). New concrete must be allowed to cure for a minimum of 28 days prior to applying a protective lining system. This usually is sufficient time to allow for shrinkage and for new concrete pours to dissipate a sufficient amount of moisture.
- B. All concrete structures to receive lining system must be properly designed and capable of withstanding imposed loads. Surfaces must be dry, firm, free of laitance, form release agents, standing water and have attained 3000-psi compressive strength or be structurally sound as determined by USACE COR.
- C. Suitable surface preparation methods include Shotblasting, Abrasive Blasting, or Water Jetting. Surface preparation procedures shall be in accordance with ICRI Guideline No. 03732. Surface preparation requirement is to expose aggregate and obtain a uniform surface texture resembling ICRI CSP # 3-5 comparators. (Note: ICRI = International Concrete Repair Institute.)

1. Moisture Testing

- a. Floors - New concrete should be installed over a moisture barrier to eliminate moisture transmission through the concrete floor. Prior to the application of materials, the moisture content must be determined using a suitable Moisture Detection System per ASTM F-1869 - "Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride." One such manufacturer is Sealflex Industries, 2925 College Ave. #B4, Costa Mesa, CA (714-708-0850). An average value exceeding 3.0-lbs/1000 ft²/24-hr period is unacceptable and will require additional cure time, the application of a surface penetrating vapor barrier or other corrective measure. Re-test after taking corrective measures to ensure an average value below 3.0 lbs.

3.02 EPOXY PRIMER

- A. Apply penetrating epoxy primer to seal concrete and promote adhesion.
- B. Follow manufacturer's instructions for mixing and installation.

3.03 EPOXY LINING

- A. Apply a corrosion-resistant, spray applied epoxy lining to the prepared area.
- B. Follow manufacturer's instructions for mixing and installation.

3.02 EPOXY GLAZE

- A. Apply an epoxy glaze to provide a smooth surface.
- B. Follow manufacturer's instructions for mixing and installation.

3.03 SETTING/CURING

- A. Primer must be allowed to cure at least three hours but not more than 24 hours prior to application of an epoxy system. If recoat time exceeds 24 hours, consult manufacturer.
- B. Epoxy Lining should be applied at a temperature of 70°F, allow a minimum of 8 hours, maximum of 24 hours prior to topcoating with No. 210GL - Glaze.
- C. Glaze - Do not allow flowing water or chemicals on the glaze for a minimum of 24 hours at 70°F. For temperatures below 70°F, cure a minimum of 48 hours prior to flowing water or chemical exposure.

3.04 CLEAN-UP

The project site shall be maintained in a professional manner. Coating and paint spots, overspray, oil, and other stains upon adjacent surfaces shall be removed. All damage to surfaces resulting from the work shall be cleaned, repaired, or refinished to the satisfaction of the Owner at no cost to the Owner.

END OF SECTION

SECTION 16010

ELECTRICAL

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall install, ready for use, the electrical system as specified in Division 16 and shown on the Contract Drawings. This document describes the function and operation of the system and particular components, but does not necessarily describe all necessary devices. All components and devices shall be furnished and installed as required to provide a complete operable and reliable system for accomplishing the functions and meeting the performance set forth hereinafter.
- B. ~~Contractor's BASE bid shall include first or second named or second named as indicated on the Drawings or in these Specifications. Any proposed substitutes (or "equals") shall be listed separately in the base bid, and called out as an "alternate" with an appropriate deduct from, or additional cost to, the base bid. Where Drawings or Specifications call for a particular manufacturer "or equal", the Contractor must prepare his base bid using the first or second named equipment. Contractor shall bear the full responsibility for including in his base bid any equipment which is later found to be unacceptable or NOT equal to the equipment specified.~~
- C. Furnish all required labor, materials, project equipment, tools, construction equipment, safety equipment, transportation, test equipment, incidentals, and services to provide a complete and operational electrical system as shown on the Drawings, included in these Specifications, or required for fully operating facilities. Use Device Indexes and Contract Drawings typical installation details for mounting detail requirements to be provided for equipment listed.
- D. Examine the Specification and Drawings for mechanical equipment and provide all starters, circuit breakers, switches, pushbuttons and appurtenances which are not specified to be with the mechanical equipment. Erect all electrical equipment not definitely stated to be erected by others, furnish and install conduit, wire, cable, and make connections required to place all equipment in complete operation.
- E. Contract Elementary Drawings do not show all electrical interfaces, lockouts, etc. required for motor control. These Drawings show general layout and have made provisions for interlocks, solenoid valve control, etc. and are only typical. Contractor is responsible for examining the Contract I Series Drawings for all motor control interfaces, temperature switches, solenoid valves, float switches and device lockout, requirements. The Contractor's submitted elementary diagrams shall show all motor controls and interlocks for the specific piece of equipment. Provide a separate set of elementary diagrams for each similar group of equipment. It is within the Contractor's scope of work to submit elementary diagrams that not only show the MCC bucket wiring, but also include the field interlocks, motor heaters, protective devices, valve controls, etc. The Contractor's Elementary submittal Drawings shall also show field terminal block numbers for each of the field interlocks and valve controls.
- F. The major areas in the Division scope of work are shown on the E & I series drawings which include both the furnishing and installation are:
 - 1. Motor Control Centers including Variable Frequency Drives (VFD), soft starters and motor starters.

2. Modifications to existing main switchboard (SWBD-1).
 3. Processor Logic Controllers (PLC) and Operator Interface (OI) hardware for controlling the pumps, aerators, drives, etc. and other miscellaneous devices. The Contractor is to provide all configuration, programming and setup of the PLCs & OIs.
 4. Generator and above ground fuel tank.
 5. Conduits, and the field interconnection wiring between the equipment, pumps, MCCs, control panels, panelboards, field devices, etc.
 6. All necessary miscellaneous shut off, sample, and calibration valves to sensors.
 7. Trenching, backfilling, compaction, and resurfacing for all new underground conduit routes.
 8. Building electrical devices, lights, and receptacles.
 9. Grounding system and equipment grounding.
 10. Concrete pads and supports for electrical and instrumentation equipment.
 11. SCADA graphic screen configuration and modifications to existing PLC-1 shall be by Contractor.
 12. Installation of primary devices, equipment and instruments, are not completely detailed on Contract drawing plan sheets. Use 16940 Device Index and Contract Drawings installation details for installation and mounting requirements.
 13. Conduits, wiring, and terminations of all wiring associated with panels and equipment supplied under all other Divisions.
 14. Removal and disposal of excess materials from excavation, pavement removal and demolition work.
- G. No items for panels or MCCs shall be shipped loose for later field installation in MCC, control panel, enclosures, etc. without prior written approval of the Government unless it is for retrofit into existing equipment. Incomplete panels or MCC arriving at the jobsite shall be returned by the Contractor to the shop to complete fabrication at no additional cost to the Government when directed by the Government.
- H. Provide all necessary hardware, conduit, wiring, fittings, and devices to connect the electrical equipment provided under other Sections. The following shall be done by the Contractor at no additional cost to the Government:
1. Provide additional devices, wiring, conduits, relays, and isolators to complete interfaces of the electrical and instrumentation system.
 2. Changing normally open contacts to normally closed contacts or vice versa.
 3. Adding additional relays to provide more contacts as necessary to carry out work specified.
 4. Other work implied by the Contract documents.

- I. The following Specifications incorporate specific equipment and devices that are preferred by the Government because of their serviceability, because of the local availability of labor, parts and materials, or because of the ability of the Government to umbrella the equipment under existing maintenance Contracts; however, favorable alternatives proposed in writing during the submittal process will be reviewed by the Government as whether it is acceptable as an approved equal.
- J. All electrical equipment and materials, including installation and testing, shall conform to the applicable codes and standards listed in this and other Sections. All electrical work shall conform with the National Electric Code (NEC) 2002 issue. Nothing on the Drawings nor in the Specifications shall be construed to permit work or materials not conforming to these codes and standards.
- K. Contractors which propose to bid on this project shall attend the pre-bid job walk to accomplish the following:
 - 1. Thoroughly examine existing conditions before submitting his bid proposal to perform any work. He shall compare site conditions with data given on the plans or in these Specifications. No allowance shall be made for any additional costs incurred by the Contractor due to his failure to have examined the site or to have failed to report any discrepancies to the Government prior to bid.
 - 2. Verify all measurements and conditions and shall be responsible for the correctness of same. No extra compensation will be allowed because of differences between work shown on the Drawings and measurements at the site.
- L. It is the Contractor's responsibility to be fully familiar with the existing conditions and local requirements and regulations.
- M. Any major deviations in location and conduit routing that the Contractor makes without the express written review or direction of the Engineer, shall be considered to have been made at the Contractor's sole responsibility. Such deviations made by the Contractor shall be reflected on the Contractor supplied "Record Drawings" and Conduit Schedule. The Government will reimburse the Electrical Engineer and the Government and then will deduct an amount equal of reimbursement from the Contractor's contract for all engineering, drafting, and clerical expenses associated with updating the Record Drawings and Conduit Schedule due to any major unauthorized changes.
- N. The term "Engineer" used throughout this Division 16 is the "USACE-COR" Engineer or their designated Engineer representative." The term "Government" in Division 16 is the US Army Corp of Engineers. When "Contractor" is listed in these documents without further definition such as "Contractor", it is to mean the "Prime or General Contractor."

1.02 CODES AND STANDARDS

- A. All electrical/instrumentation equipment and materials, including installation and testing, shall conform to the following applicable codes and standards:
 - 1. ANSI - American National Standards Institute, Inc.
 - 2. EIA - Electronics Industries Association.
 - 3. ETL - Electrical Testing Laboratories.
 - 4. FM - Factory Mutual.

5. GO128 - General Order No. 128, Rules for Construction of Underground Electrical Supply and Communication Systems, Public Utilities Commission of the State of California.
 6. IEEE - Institute of Electrical and Electronics Engineers.
 7. ICEA - Insulated Power Cable Engineers' Association.
 8. ISA - International Society for Measurements & Control (ISA) Standards (formerly Instrument Society of America).
 9. JIC - Joint Industrial Council.
 10. NEC - National Electrical Code, 2002 Edition.
 11. NEMA - National Electrical Manufacturers Association.
 12. NETA - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, International Electrical Testing Association.
 13. NESC - National Electrical Safety Code.
 14. NFPA - National Fire Protection Agency.
 15. OSHA - Occupational Safety and Health Act Standards.
 16. UL - Underwriter's Laboratories, Inc.
- B. The revisions of these codes and standards in effect on the date of issuance of the Contract Documents shall apply.
 - C. Codes and standards referenced shall be considered minimum acceptable work.
 - D. In instances where two or more codes are at variance, the most restrictive requirements shall apply.
 - E. Nothing on the Drawings nor in the Specifications shall be construed to permit work or materials not conforming to the preceding codes and standards.
 - F. All work shall also be performed in accordance with the District, State, County or District standards, and local Utility codes.
 - G. The Contractor shall furnish without extra charge any additional material and labor which may be required for compliance with these codes and standards, even though the work is not explicitly mentioned in the Specifications or shown on the Contract E- Series Drawings.
 - H. Amperage listed on the single-line Drawings for motors are per NEC Table 430-150 and may not necessarily match that of the equipment supplied. It is the electrical system supplier and Contractor's responsibility to furnish equipment sized for the motors supplied for this project at no additional cost.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. The following are covered in other sections in the Contract documents and are part of Division 16.
 - Section 16011 – Electrical and Instrumentation Submittals and Drawing Requirements.
 - Section 16012 – Electrical and Instrumentation Operations and Maintenance Data.
 - Section 16013 – Electrical and Instrumentation Spare Parts.
 - Section 16020 – Seismic Restraint for Electrical Equipment.
 - Section 16110 – Conduits.
 - Section 16111 – Conduit Schedule.
 - Section 16115 – Duct Banks, Vaults, and Pull Boxes.
 - Section 16120 – Wire, Fuses, and Terminal Blocks.

Section 16140 – Wiring Devices.
 Section 16144 – Nameplates.
 Section 16190 – Supporting Devices.
 Section 16210 – Diesel Generator.
 Section 16440 – Disconnect Switches.
 Section 16450 – Grounding.
 Section 16470 – Panelboard and Panelboard Transformer.
 Section 16480 – Motor Control Center.
 Section 16481 – Variable Frequency Drive.
 Section 16482 – Soft Starter.
 Section 16500 – Lighting and Fixtures.
 Section 16605 – Electrical System Analysis.
 Section 16610 – Electrical and Instrumentation Factory Tests.
 Section 16620 – Electrical and Instrumentation Field Tests.
 Section 16900 – Electrical and Instrumentation Training.
 Section 16911 – Processor Logic Controller Hardware.
 Section 16912 – PLC Firmware & Programming Software.
 Section 16913 – PLC Applications Programming.
 Section 16914 – PLC I/O List.
 Section 16915 – PLC Control Strategies.
 Section 16940 – Instrumentation.

B. The contents of this Section apply to all "electrical and instrumentation" equipment suppliers and manufacturers doing work listed in following sections:

1. Section 01300 - Submittals.
2. Division 11.
3. Division 15.

1.04 CONTRACTOR QUALIFICATIONS

A. It is the intent of this Division that the complete responsibility for management and installation of the electrical and instrumentation required for this project be by the Contractor. This responsibility includes, but is not limited to, supervision and coordination of work performed by the System Supplier.

~~B. Contractor shall submit the proposed Electrical Sub-Contractor and System Supplier with bid documents that will be used on this project.~~

~~C.B. If the Contractor, General Contractor and System supplier listed in bid documents are deemed not qualified by Government, they will have their bid rejected at the Government's sole discretion and the next qualified bidder selected.~~

~~D.C.~~ The Contractor shall meet the following minimum qualifications:

1. Has a current C-10 Contractor's License.
2. Has regularly engaged in similar electrical Contracting for the municipal water and wastewater industry.
3. Has performed work of similar or greater complexity on at least five previous projects under one company name which is the present company name.

1.05 SYSTEM SUPPLIER QUALIFICATIONS

A. General:

1. All switchboard, panels, MCCs, PLC hardware, and PLC programming shall be supplied by one system supplier. All panels and instrumentation listed for Division 16 in all Division 16 appendix Indexes shall be supplied by the same System Supplier. This includes, but not limited to, all work necessary to select, furnish, supervise installation, calibrate, program, and place into operation all transmitters, instruments, controllers, alarm equipment, monitoring equipment, and accessories as specified herein. The system supplier shall not subcontract any portions of the equipment provisioning with the exception of fire and security alarm systems without written approval of Government.
2. The system supplier shall have an on-staff project engineer with prior experience on similar sized projects. This project engineer shall coordinate the technical aspects of this project and prepare the submittals and drawings. This project engineer's name, address, and phone number shall be provided within the first week after notice to proceed. The system supplier project engineer shall attend all coordination meetings and be on-site when requested by the Government's Resident Engineer.

B. System Suppliers Qualifications

1. ~~It is the intent of the Government to secure the highest quality of work for this project. System Suppliers shall submit the information listed herein two weeks prior to bid, and if approved by the Government, will be listed in a Contract addendum prior to bid for providing bids as system suppliers on the project.~~
2. The System Supplier shall submit prove they meet the following minimum qualifications:
 - a. Has regularly engaged in similar instrumentation systems for the Municipal Water and Wastewater industry.
 - b. Has successfully performed work of similar or greater complexity on at least five previous projects of similar or greater size under one company name which is the present company name.
 - c. Has been actively engaged in the type of PLC control system, and instrumentation work specified in this Division for a minimum of five years.
 - d. Has a permanent, fully staffed, and equipped service facility in operation at least six (6) months prior to bid date within 150 miles of project site. Service facility shall be under same company name as System Supplier and same company shall be staffed with personnel and equipment required to maintain, repair and calibrate the instrumentation system. Subletting warranty to third party is not acceptable.
3. ~~System Suppliers shall submit the following detailed information to the Government for determination of pre-qualification:~~
 - a. ~~Company history.~~

~~b. List of five (5) completed projects of similar size and nature for wastewater treatment plants.~~

~~1) Provide completion dates of projects.~~

~~2) References of Government Representative in charge of project, including contact name and telephone number.~~

~~c. List of projects in progress.~~

~~1) Description of scope of projects.~~

~~2) Dollar amount of projects.~~

~~d. Complete 2003 Year End Financial statement prepared by a Certified Accountant or complete 2003 Company Tax Returns listing assets and liabilities.~~

~~4. Additional information for clarification as requested by the Government in writing shall be provided by the System Supplier asking for the qualification or qualification will automatically be denied.~~

~~5. System Supplier providing financial statements lacking detail or stating that detailed financial records are proprietary will be disqualified as a qualified System Supplier and is grounds alone for disqualification.~~

~~6. Any qualification package deemed incomplete or lacking sufficient information to determine qualification will result in System Supplier not being qualified.~~

~~7.3. No reason will be released on why a System Supplier was not qualified.~~

1.06 CONTRACT DOCUMENTS

- A. The Contract Drawings and Specifications are intended to be descriptive of the type of electrical system to be provided; any minor details missing in either shall not relieve the Contractor from the obligations thereunder to install in correct detail any and all materials necessary for a complete operational system at no additional cost.
- B. The Contract Drawings are generally diagrammatic; exact locations of electrical products shall be verified in the field with the Government's Resident Engineer. Except where special details on Drawings are used to illustrate the method of installation of a particular piece or type of equipment or materials, the requirements or descriptions in this Section shall take precedence in the event of conflict.
- C. The Contract Electrical elementary, elevation and one-line diagrams are the basis of the electrical system to be provided and are for reference only. It is the Contractor's responsibility to adjust and make minor revisions to the diagrams as necessary for operational system at no additional cost to the Government. Additional isolators, relays, wiring, terminal blocks, etc, shall be provided for an operation system at no additional cost to the Government. Each type shown on Contract Drawings of MCC bucket elementary wiring shall be factory tested and witnessed by the Government prior to full scale production of other similar MCC buckets.

- D. Location at facilities of new equipment, inserts, anchors, panels, pull boxes, conduits, stub-ups, and fittings for the electrical system are to be determined by the Contractor and Engineer at time of installation. Contractor shall make minor adjustments to locations of electrical equipment required by conditions and coordination with other trades at no additional cost. Minor adjustments are defined as those adjustments required due to equipment size changes or variations between different equipment suppliers.
- E. The Conduit and Wire Routing Schedule, wire fill, and number of conduits are based on the best information available. It is the Contractor's responsibility to modify the conduit schedule based upon Shop Drawings for the actual equipment. Such modifications in conduit sizes and numbers of conductors shall be at no additional cost to the Government, if such changes are the direct result of the equipment selected by the Contractor. A copy of the Conduit and Wire Routing Schedule and Electrical plans showing conduit routing shall be updated weekly by the Contractor. Progress payments will be withheld if during monthly checks it is found that the contractor fails to maintain the Conduit Schedule updates.
- F. Electrical & instrumentation, conduit & wire lengths shown on circuit Drawings are approximate and do not show changes in elevation or vertical risers. The Contractor is responsible for determining actual lengths for bidding and installation purposes.
- G. All equipment shall be installed and located so that it can be readily accessed for operation and maintenance. The Engineer reserves the right to require minor changes in location of equipment, without incurring any additional costs. These minor changes are changes which would provide adequate clearance and work areas in front of and around equipment.
- H. Where conduits are shown as "home runs" on the Contract Drawings or stated to be furnished, but not explicitly shown as part of the scope of work, the Contractor shall provide all fittings, boxes, wiring, etc., as required for completion of the raceway system in compliance with the NEC and the applicable Specifications in this Section.
- I. No changes from the Contract Drawings or Specifications shall be made without written approval of the Engineer. Should there be a need to deviate from the Contract documents, submit written details and reasons for all changes to the Engineer for review within thirty days after the award of the contract.
- J. The resolution of conflicting interpretation of the Contract documents shall be as determined by the Engineer.
- K. The Contractor shall maintain a separate set of neatly and accurately marked set of Record Documents, consisting of spreadsheets, specifications and full size blue-line Electrical (E-Series) and Instrumentation (I-Series) Contract Drawings. These documents are to be used specifically for recording the as built locations and layout of all electrical and instrumentation equipment, routing of raceways, junction and pull boxes, and other diagram or document changes. These Record documents shall be kept up-to-date during the progress of the job, with all "change orders", submittal modifications, and construction changes shown and stamped with "As-Built" at end of job. These Record documents shall not be used for daily construction use and shall not contain any mark-ups that are unrelated to as-built corrections.
 - 1. The following lists the record documents shall be as-built by Contractor:
 - a. E-Series Drawings.
 - b. Panelboard schedules.
 - c. Conduit and Wire Routing Schedule.
 - d. Lighting Schedule.

- e. Duct banks and their routing with offset measurement and indicate changes in depth.
- 2. The following lists the record documents that shall be as-built by System Supplier to be maintained by Contractor:
 - a. I-Series Drawings.
 - b. Section 16915 PLC Control Strategies.
 - c. Section 16914 PLC I/O Lists.
- 3. Record documents shall be kept current weekly with all "change orders", submittal modifications, and construction changes shown. Record Documents shall be subject to the inspection by the Engineer at all times, progress payments or portions thereof may be withheld if Record Documents are not accurate or current.
- 4. When documents are changed, they shall be marked with erasable colored pencils using the following coloring scheme:
 - a. Additions – red.
 - b. Deletions – green.
 - c. Comments - blue.
 - d. Dimensions – black.
- 5. Show the following on the Electrical (E-Series) Record Contract Drawings by dimension from readily obtained base lines:
 - a. Exact location, type and function of electrical and instrumentation equipment and devices.
 - b. Precise routing and locations of underground conduits, pullboxes, junction boxes, etc. that make-up the raceway system.
 - c. Show the dimensions, location and routing of electrical work which will become permanently concealed.
 - d. Show complete routing and sizing of any significant revisions to the systems shown.
- 6. Prior to acceptance of the work, the Contractor shall deliver to the Engineer one set of record full-size Electrical & Instrumentation series Record Contract Drawings and spreadsheets neatly marked accurately showing the information required above.

1.07 SUBMITTAL AND DRAWING REQUIREMENTS

- A. Provide electrical and instrumentation submittals per Section 16011 - Electrical and Instrumentation Submittal Requirements and Section 01300 - Submittals.

1.08 COORDINATION

- A. The Contractor shall coordinate the electrical work with the other trades, code authorities, utilities, and the Engineer, with due regard to their work, towards promotion of a rapid completion of the project. If any cooperative work must be altered due to lack of proper supervision of such, or failure to make proper provisions, then the Contractor shall bear expense of such changes as necessary to be made in the work of others.

- B. The Contractor shall examine the architectural, mechanical, structural, electrical, and instrumentation equipment provided under other Sections of this Contract in order to determine the exact routing and final terminations for all conduits and cables. The exact locations and routing of cables and conduits shall be governed by structural conditions, physical interferences, and the physical location of wire terminations on equipment. Conduits shall be stubbed up as close as possible to equipment terminals.
- C. Manufacturer's directions and instructions shall be followed in all cases when they have more restrictive requirements than that shown on the Contract Drawings or have stipulations in order to meet warranty requirements.
- D. The Contractor shall schedule a minimum of two (2) mandatory coordination meetings during the initial and submittal phase of the project. The meetings shall be held at the jobsite and include, as a minimum, attendance by the Government's Resident Engineer, Prime Contractor, Contractor, System Supplier Engineer, and Design Engineer.
 - 1. The first meeting shall be held in advance of the first comprehensive submittal and no later than 21 days after Contract award. The purpose of the meeting shall be for the Contractor and System Supplier to summarize their understanding of the project, discuss any proposed substitutions or alternatives, review the project schedule, explain format of Drawings, and discuss any other topics deemed necessary for project coordination.
 - 2. The second meeting shall be held after the review of the first comprehensive System Supplier submittal has been completed by the Government. The purpose of the meeting is to discuss comments made on the submittal package, to update the project schedule, and coordinate the testing, training, and installation phases of the project.
- E. The electrical and instrumentation modifications and additions are to be made at the operational El Dorado Irrigation District Deer Creek Wastewater Treatment Plant. The Contractor shall schedule all the required work with the District, including each shutdown period. Each shutdown shall be implemented to minimize disruption of the existing operations. The work to be provided under this Contract shall not disrupt any of the existing operations without prior approval.
 - 1. The Contractor shall limit all unscheduled shutdown periods to less than 1 hour and only with prior approval of the District.
 - 2. Carry out scheduled shut downs only after the time, date, and sequence of work proposed to be accomplished during shutdown has been favorably reviewed by the District. Submit shutdown plans at least 2 days in advance of when the scheduled shutdown is to occur.
 - 3. The District reserves the right to delay, change, or modify any shutdown at any time, at no additional cost to the District, when the risk of such a shutdown would jeopardize the operation of system.
- F. The Contractor shall be responsible for coordinating PLC/SCADA design review meetings specified in Section 16913.
- G. The Contractor shall cease work at any particular point, temporarily, and transfer his operations to such portions of work as directed, when in the judgment of the Government it is necessary to do so.

- H. Prior to commencing construction, the Contractor shall arrange a conference with the Prime Contractor and Government's Resident Engineer as well as all major equipment suppliers, and shall verify types, sizes, locations, controls and installation requirements of all proposed equipment. He shall, in writing, inform the Government's Resident Engineer that all phases of coordination of this equipment have been covered and if there are any unusual conditions, they shall be enumerated at this time.

1.09 SUPERVISION

- A. The Contractor shall schedule all activities, manage all technical aspects of the project, coordinate submittal and Drawings, and attend all project meetings associated with this Section.
- B. The Contractor shall supervise all work in this Section, including the Contractor's general construction work, and System Supplier's work, from the beginning to completion and final acceptance.
- C. The Contractor shall supervise and coordinate all work in this Section to insure that each phase of the project, submittal, delivery, installation, and acceptance testing, warranty, etc., is completed within the allowable scheduled time frames.
- D. The Contractor shall be responsible for obtaining, preparing, completing, and furnishing all paper work for this Section including that of the Contractor and the System Supplier, which shall include transmittals, submittal, forms, documents, manuals, instructions, and procedures.
- E. Electrical Construction Supervision:
 - 1. Prior to the start of any project site installation, the Contractor shall provide the Government with an expected man power schedule as well as a list of applicable job site supervision personnel, their scheduled job site appearance, and the expected duration of their presence on the job site. Include in this manpower schedule the calculation of average manhour per month for the duration of electrical labor phase.
 - 2. When the Electrical Labor exceeds an average of 2,000 man-hours/month the Contractor shall have a office clerk on site for the duration of the construction work to order, follow up and receive materials, handle construction payroll, maintain the Construction Documents, and handle or assist the working foreman/superintendent with responsibility not directly related to the installation of the electrical equipment.
 - 3. The Contractor shall have a dedicated Project Manager in addition to the Office Clerk described above, on site for the duration of the construction work. The Project Manager shall have complete authority and responsibility for carrying out all aspects of the Contract with the Government.
 - 4. The Contractor shall provide a foreman for each six (6) installation labor electricians. A Job Site Superintendent shall be provided at the discretion of the Contractor unless the project falls behind schedule. If the project falls behind schedule, the Government can direct the Contractor to provide a non-working Superintendent who must remain with the project a minimum of the next two (2) project schedule deadlines.

1.10 INSPECTIONS

- A. All work or materials covered by the Contract documents shall be subject to inspection at any and all times by the Engineer. If any material does not conform to the Contract documents, or does not have an "approved" or "approved as noted" submittal status; then the Contractor shall, within three days after being notified by the Engineer, remove the unacceptable material from the premises; and if said material has been installed, the entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the Contractor.
- B. Work shall not be closed in or covered over before inspection and approval by the Government's Resident Engineer. All costs associated with uncovering and making repairs where noninspected work has been performed shall be borne by the Contractor.
- C. The Contractor shall cooperate with the Government and provide assistance for the inspection of the electrical system under this Contract. The Contractor shall remove covers, provide access, operate equipment, and perform other reasonable work which, in the opinion of the Engineer, will be necessary to determine the quality and adequacy of the work.
- D. Before request for final inspection is made, the Contractor shall submit to the Government in writing, a statement that the Contractor has made his own thorough inspection of the entire project enumerating punch list items not complete and that the installation and testing is complete and in conformance with the requirements of this Division.
- E. The Government may arrange for a facility inspection by Cal-OSHA Consultation Service at any time. The Contractor shall make the necessary corrections to bring all work in conformance with Cal-OSHA requirements, all at no additional cost to the Government.
- F. "Contractor will be Responsible for any Additional Cost for Overtime, Weekend Overtime or Differential Time, Expenses for Inspection of Defective Work that has to be Reinspected".

1.11 JOB CONDITIONS

- A. The Contractor shall make all arrangements and pay the costs thereof for temporary services required during construction of the project, such as temporary electrical power and telephone service. Upon completion of the project, remove all temporary services, equipment, material, and wiring from the site as the property of the Contractor.
- B. The Contractor shall provide adequate protection for all equipment and materials during shipment, storage, and construction. Equipment and materials shall be completely covered with two layers of plastic and set on cribbing six inches above grade so that they are protected from weather, wind, dust, water, or construction operations. Equipment shall not be stored outdoors without the approval of the Government. Where equipment is stored or installed in moist areas, such as unheated buildings, provide an acceptable means to prevent moisture damage, such as a uniformly distributed heat source to prevent condensation.
- C. The elevation of the project site is approximately 870 feet above sea level. All equipment shall be derated as recommended by the manufacturer or in accordance with ANSI C37.30.
- D. The normal, unconditioned ambient temperature range of the job site will vary between 10° to 110 °F. All equipment shall be rated to operate at continuous full load under these temperature ranges. Any additional provisions for cooling or heating shall be provided to meet these requirements at no additional cost.

E. Corrosion Protection:

1. The Contractor is specifically cautioned that the treatment plant ambient air contains airborne contaminants, including but not limited to, the corrosive gasses: hydrogen sulfide, chlorine and ammonia. The corrosion severity level will vary according to specific locations, temperature, relative humidity, ratio of change of relative humidity, wind speed and wind direction, and may, therefore, also be subject to seasonal variation.
2. Unless otherwise specified, equipment shall be installed such that no significant or detrimental corrosion shall occur over a 20 year period. Installation in a stainless steel NEMA 4X enclosure is acceptable to meet this requirement.
3. Class 1, Div 2 Areas:
 - a. Areas noted as Class 1, Div 1 or 2 areas may contain gases or vapors that are hazardous. The Contractor shall take all precautions to maintain personnel safety by always having working gas monitors present in Class 1, Div 2 areas or by other methods.
 - b. All Electrical construction in Class 1, Div 1 or 2 areas shall be installed as follows:
 - 1) Explosionproof.
 - 2) Intrinsically safe.

1.12 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals covering instructions and maintenance on each type of equipment shall be furnished per Section 16012 – Electrical and Instrumentation Operations and Maintenance Data.

1.13 AREA CLASSIFICATION

- A. Where equipment ratings are not specifically called out on the drawings or indexes, they shall be supplied with the following ratings:
1. Wet environments requiring NEMA 4X enclosures and construction:
 - a. Indoors in water corrosive or chemical exposed areas.
 - b. All equipment mounted outdoors.
 2. Dry heated areas requiring NEMA 12 enclosures and construction:
 - a. Indoor equipment not in water corrosive or chemical exposed areas.
 3. Seismic Classification:
 - a. The site is within Seismic Zone 4. All electrical equipment and construction techniques must be designed and braced per Section 16020 Seismic Restraint for Electrical Equipment.

4. Locations requiring Class 1, Division 1 rating:
 - a. Headworks screening area.
 - b. All wetwells of submersible sewage or wastewater pumps.

1.14 CHANGE ORDER PRICING

- A. All change order pricing by Contractor or System Supplier shall be broken out into the following minimum categories:
 1. Labor per hour listed per discipline, i.e. Supervisor, Manager, Journeyman, Engineer, Drafter, Estimator, Programmer, Secretarial, etc.
 2. Materials and equipment itemized per component and quantity.
 3. Conduit and wiring size, lengths and costs per foot for material only.
 4. Rentals, travel, per diem, etc.
 5. Tax.
 6. Shipping.
 7. Insurance.
 8. Overhead and profit.
- B. Lump sum change order pricing is not acceptable.
- C. If Contractor or System Supplier refuse to provide a change order with broken out pricing, the Engineer reserves the right to obtain independent estimates from other Contractors or System Suppliers. The Contractor or System Supplier who refused to provide the change order with broken out pricing, will be charged for the preparation of the independent estimates.

PART 2: MATERIALS

2.01 QUALITY

- A. It is the intent of the Contract Specifications and Drawings to secure the highest quality in all materials and equipment in order to facilitate operation and maintenance of the facility. All equipment and materials shall be new and the products of reputable suppliers have adequate experience in the manufacture of these particular items. For uniformity, only one manufacturer will be accepted for each type of product. Provide the manufacturer's latest design that conforms to these Specifications.
- B. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately stayed, braced, and anchored, and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service. Light duty, fragile, and competitive grade devices of doubtful durability shall not be used.
- C. Products that are specified by manufacturer, trade name, or catalog number, establish a standard of quality and do not prohibit the use of approved equal of other manufacturers. However, all provided products specified or not, must be favorably reviewed and approved by the Engineer prior to installation.
- D. Underwriter's Laboratories (UL) listing is required for all substituted equipment when such a listing is available for the first named equipment.
- E. When required by the Contract Specifications or requested by the Engineer, the Contractor shall submit equipment or material samples for test or evaluation. The samples shall be furnished with information as to their source and prepared in such quantities and sizes as may be required for proper examination and testing, with all freight and charges prepaid. All samples shall be submitted before shipment of the equipment or material to the job site and in ample time to permit the making of proper tests, analyses, examinations, rejections, and resubmissions before incorporated into the work.
- F. It is the System Supplier's responsibility to visit jobsite to collect and document existing equipment device part numbers in order for all new equipment to match existing.

2.02 COMPONENTS

A. SWITCHES AND LIGHTS

- 1. General:
 - a. Water and oil tight as defined by NEMA 4X, corrosion-resistant ultra violet light resistant UL listed.
 - b. Standard 30 mm diameter, with round plastic clamp ring.
 - c. Operating temperature range +14°F to 131°F.
 - d. Electrical Design life cycle - 1,000,000.

- e. Vibration – 10-2000Hz 1.52mm displacement (peak to peak).
 - f. Devices to be mounted or supplied for existing MCCs shall match the style and type of existing devices.
2. Hand Switch (HS):
- a. Selector switches for hand-off-auto (HOA) applications shall have the hand position to the left, off in center, and auto in the right position.
3. Hand Control (HC):
- a. Pushbutton caps shall be colors shown on Contract Drawings or approved in submittals.
4. Indicating Lights:
- a. Full voltage LED type.
 - b. Round plastic lens and miniature bayonet lamp base.
 - c. Manufacturer's standard legend plates shall be provided.
 - d. Indicating light type and color of lens shall be as shown on the Drawings or specified in the Contract documents.
 - e. Indicating lights designated "PTT" shall be provided with a push-to-test switch and wiring.
5. Potentiometer:
- a. Provide manual single turn potentiometer.
 - b. Potentiometer shall be 10K ohm.
6. Lockout Stops:
- a. Pushbutton, with red cap and padlocking assembly to lock switch in off position with padlock.
 - b. Pushbutton, and padlocking assembly shall be of the same manufacturer.
7. Push-pull Switches:
- a. Red mushroom operator, two position switch that latches in both "in" and "out" positions.

B. Relays and Timers:

1. General: Relays and timers shall be provided with N.O. or N.C. contacts as shown on the Contract Drawings. All spare contacts shown shall be provided. A minimum of two isolated form C contacts, shall be provided on each timer or relay. Contacts shall be rated 10 amps minimum at 120 VAC, 60 Hz unless otherwise stated. Supply power or coil voltage shall be 120 VAC unless otherwise shown on the Contract Drawings or when relay is utilized in 24VDC control circuits. Relays and timers shall be designed for continuous duty. All relays shall be UL listed. The following is a summary of abbreviations associated with relays and timers:
 - a. CR - control relay
 - b. ISR – intrinsic safe relay
 - c. PFR - power fail relay
 - d. TR - time delay relay
 - e. TDOE - time delay on energization
 - f. TDOD - time delay on dropout
2. Control relays (CR) shall be plug-in type with clear see-through sealed or enclosed housing to exclude dust. Contact material shall be silver cadmium oxide. Relay shall be rated for 110% of rated voltage and have a frequency response of 1800 operations per hour. Sockets for plug-in relays shall be standard industrial type blade 8 or 11 pin with barrier pressure screw terminals. Provide relay energized neon lamp or LED (inside relay case).
3. Intrinsic safe relay (ISR) shall be operate from 120VAC power with direct mode of operation operate. ISR shall be solid state, FM approved for use in Class I, Division I atmospheres with internal surge suppression. Contact rating shall be 8A and have both N.O. and N.C. contacts. Secondary voltage shall be 13VAC. ISR shall have latch and un-latch inputs for use with a two float control system for differential level control. Sensitivity shall be 10,000 ohms. ISR shall be rated for Class 1, Division 2 sewage wetwell and equalization tank applications.
4. The power fail monitor (PFR) shall continuously monitor the three phases for power loss, over/under voltage, phase loss, phase unbalance and phase reversal. The power fail monitor shall have a drop-out voltage adjustment and status indicating LEDs. Monitor shall have adjustable delay-on-make and delay-on-break timers. Fault delay shall be adjustable from 1 to 15 seconds. Monitor shall have 32 character LCD display with green back light, and 5 buttons. All adjustimers shall be made through the display and buttons. All parameters shall be stored in permanent non-volatile memory.
5. Time delay relays (TR) shall be solid state plug-in relays with a timer adjustable over eight (8) multi-time range 1 second to 10 minutes and from 1 minute to 10 hours unless other ranges are indicated or required. Provide LED timer energized indicator lamps. Timer shall have +/- 0.25% repeat accuracy. Sockets for plug-in timers shall be standard industrial type blade 8 or 11 pin with barriered pressure screw terminals.
6. Provide and install all moisture or temperature protection relays when required for equipment or motor/pump warranty conditions including any additional conduits for low voltage signal wiring. Submitted drawings shall include the wiring and terminations for all of these relays.

C. Circuit Breakers:

1. Circuit breakers shall be of the indicating type, providing ON, OFF and TRIPPED positions of the operating handle. Circuit breakers shall be quick-make, quick-break, with a thermal-magnetic (TM) action, except when protecting motor feeders where motor circuit protector (MCP) breakers with adjustable magnetic trip shall be used. Circuit breakers shall be the bolted on type. The use of tandem or dual circuit breakers in a normal single-pole space to provide the number of poles or spaces specified are not acceptable. All multiple-pole circuit breakers shall be designed so that an overload on one pole automatically causes all poles to open.
2. Breakers shall be sized and have a minimum interrupting capacity as shown on Drawings and as required for the supplied equipment.
3. Breakers requiring GF trip on E-Series Drawings shall be provided with breakers with integral ground fault trip.
4. Thermal magnetic circuit breakers with frames 250A and above shall be provided with removable interchangeable trip units.
5. Breaker for HVAC equipment shall have HACR rating.
6. All breakers shall be supplied with the correct sized copper only lugs for wire sizes as listed in "Conduit & Wire Routing Schedule". Provide larger frame breaker or lug adapters as necessary when connecting to the listed oversized wire.

D. Motor Starters:

1. Motor starters (M) shall be magnetically operated, electrically held, full voltage, nonreversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepower of the supplied equipment. Contactors shall be UL rated and listed.
2. Each motor starter shall have a 120 volt operating coil rated for continuous operation.
3. Auxiliary contacts shall be provided as shown on the Drawings or as required. Each motor starter shall be furnished with a minimum of two spare auxiliary contacts in excess from those shown to be used. Auxiliary contacts shall be convertible, in the field, from normally open to normally closed, or vice versa.
4. Starters shall have adjustable overload relays. Adjustable overload relays shall be adjustable for trip point and for automatic or manual reset. Each overload shall be ambient compensated with a visible trip indicator. Each overload shall be ambient compensated and shall trip on 600% of full load current in less than 6 seconds. Each overload relay shall have a test trip pushbutton built-in and an adjustable calibrated trip with indicating dial. Three-phase starters shall have 3 overload relays. Each overload relay shall have a normally closed holding contact and a normally open isolated contact for overload shutdown.

E. Control Power Transformer:

- Control power transformer (CPT) shall be provided with a time-delay, slow-blow secondary fuse rated to protect the transformer and interrupt 10,000 amperes at 120VAC. Two primary fuses for interrupt amperes shown on Contract Drawings shall be provided. Transformer size minimum ratings shall be as shown on Contract E-Series Drawings. When size is not shown on E-series Contract Drawings, then the following lists the minimum control power transformer per NEMA Starter size or VFD/Soft Starter size:

CONTACTOR NEMA SIZE STARTER	VFD/ SOFT STARTER AMPS	CTRL PWR XFMR VA RATING (MIN)
SIZE 00	9	150
SIZE 0	18	150
SIZE 1	27	150
SIZE 2	45	150
SIZE 3	90	250
SIZE 4	135	250
SIZE 5	270	250

- The MCC supplier shall increase the CPT size by the VA rating of the motor heater when motors have heaters.

F. Elapsed Time Meters:

- Elapsed time meters (ETM) for general use shall be nonresettable with 0.0 to 99,999.9 hour readout, permanently lubricated synchronous motor drive, nominal 2-1/2" circular two-hole surface front panel mount housing, screw terminals, and rated at 120 VAC, at 60 Hz.

G. Panel Meter:

- Panel meters shall be iron-vane type, +/- 2% accuracy of full with full scale faceplate, 3-1/2" face, 90 degree rotation, front panel surface mount. Full scale shall be 0-100%.

2.03 ELECTRICAL ENCLOSURES

- Enclosures to be NEMA rated per Indexes with fast access door latches. Enclosure construction shall be 14 gauge minimum with continuously welded seams. Outer door shall have provisions for locking enclosure with standard padlock. Provide white backpan in box. Provide thermoplastic data pocket mounted on inside door. Provide enclosures with accessories consisting of breaker to disconnect incoming power, padlockable disconnect for breakers used in circuits above 120VAC, heater, fan, removable metal filters, louvers, and thermostats.

PART 3- EXECUTION

3.01 WORKMANSHIP

- A. All work in this Section shall conform to the codes and standards outlined herein.
- B. The Contractor shall employ personnel that are skilled and experienced in the installation and connection of all elements, equipment, devices, instruments, accessories, and assemblies. All installation labor shall be performed by qualified personnel who have had experience on similar projects. Provide first class workmanship for all installations.
- C. The Contractor shall ensure that all equipment and materials fit properly in his installations.
- D. The Contractor shall perform any required work to correct improper installations at no additional expense to the Government.
- E. The Engineer reserves the right to halt any work that is found to be substandard or being installed by unqualified personnel.
- F. All cutting and notching shall be laid out carefully in advance. Do not notch any structural member or building surface without specific approval from the Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces neatly to new condition using skilled craftsmen of the trades involved. Refinish damaged surfaces to new condition using skilled craftsmen of the trades involved at no additional cost to the Government.
- G. Keep the premises free from accumulation of waste material or rubbish on a daily basis. Upon daily completion of work, remove materials, scraps, and debris from the premises and from the interior and exterior of all devices and equipment.
- H. All equipment installed by the Contractor shall be in accordance with the Drawings and the manufacturer's recommendations and instructions and shall operate to the Engineer's satisfaction. Follow all manufacturer's instructions for handling, receiving, installation, and pre-check requirements prior to energization. After energization, follow manufacturer's instructions for programming, set-up and calibration of equipment. The Contractor shall be responsible for, and shall correct by repair or replacement, at his own expense, equipment which, in the opinion of the Engineer, has been caused by faulty mechanical or electrical assembly by the Contractor. Necessary tests to demonstrate that the electrical and mechanical operation of the equipment is satisfactory and meets the requirements of these Specifications shall be made by the Contractor at no additional cost to the Government.
- I. The Contractor shall vacuum clean the interior of all motor control centers, panelboards, junction boxes and other enclosures supplied under this project containing electrical equipment to remove all dirt, metal chips, stripped insulation, etc., from the enclosure. This cleaning shall be done prior to energizing the device initially and a second time immediately prior to the final acceptance inspection.

3.02 CONSTRUCTION METHODS, GENERAL

- A. All wiring shall be neatly bundled and laced with plastic tie-wraps, anchored in place by screw attached retainer. Where space is available, such as in electrical cabinets, all wiring shall be run in slotted plastic wireways or channels with dust covers. Wireways or channels shall be sized such that the wire fill does not exceed 50%. Wires carrying 100 volts and above shall be physically separated from lower voltage wiring by using separate bundles or wireways with sufficient distance to minimize the introduction of noise, crossing only at 90 degree angles.
- B. Where wiring crosses hinged surfaces, provide a "U" shaped hinge loop protected by plastic spiral wrap. The hinge loop shall be of sufficient length to permit opening and closing the door without stressing any of the terminations or connections.
- C. Wireways, retainers, and other devices shall be screw-mounted with round-head 316 stainless steel screws. Glue or sticky back attachment of any type or style shall not be used.
- D. All devices and wiring shall be installed and permanently labeled and secured in accordance with Section 16144 and Section 16120.
- E. All components associated with a particular compartment's or enclosure's function shall be mounted in that compartment or enclosure.
- F. Spacing and clearance of components shall be in accordance with UL, JIC, and NEC standards.
- G. Wires shall not be spliced except where shown. Devices with pigtails, except lighting fixtures, shall be connected at terminal blocks. Equipment delivered with spliced wires shall be rejected and the Contractor required to replace all such wiring, at no additional cost to the Government.
- H. Where splices are allowed or approved by the Engineer they shall conform with the following:
 - 1. Splices of #10 and smaller, including fixture taps, shall be made with see-through nylon self-insulated twist on wire joints twist shall be UL listed for service voltage.
 - 2. Splices of #8 and larger shall be double crimped splices, or approved equal, insulated with heat shrink tubing, or approved equal.
 - 3. Splices in underground pullboxes shall be insulated and moisture sealed with cast fast curing epoxy powdered resin splice kits. Kits used shall have a date marking for shelf life that is not expired. Kit shall be UL listed for electrical insulating systems.
 - 4. Wire splicing devices shall be sized according to manufacturer's recommendations.
 - 5. Tape on splices shall not be allowed.
 - 6. Splices for motor leads shall be made with 3M DB series splice kit, or approved equal.
- I. Tapes shall conform to the requirements of UL 510 and be rated: 105 °C, 600V, flame retardant, hot and cold weather resistant. Vinyl plastic electrical tape shall be 7 mil black. Phase tape shall be 7 mil vinyl plastic, color coded as specified. Electrical insulation putty shall be rubber based, elastic putty in tape form. Varnished cambric shall not be used.

- J. Connections to terminals shall be as follows:
1. Use connector or socket type terminals furnished with component.
 2. Connections to binding post screw, stud, or bolt use:
 - a. For #10 and smaller wire, self-insulated locking forked tongue lug, de-burred, electro-tin plating with flat bottom box.
 - b. For #8 to #4/0 wire, lug of shape best suited with code copper conductor (for 600V).
 3. Use ratchet type crimping tool which does not release until proper crimp pressure has been applied.
 4. Connections for all terminals shall be made with insulation stripped per manufacturer's instructions.
- K. Equipment shall be wired and piped by the manufacturer or supplier. Major field modifications or changes are not allowed without the written "change order" authority by the Engineer. When field changes are made, the components, materials, wiring, labeling, and construction methods shall be identical to that of the original supplied equipment. Contractor's cost to replace or rework the equipment to match original manufacturer or supplier methods shall be done at no additional cost to the Government.
- L. Mating fittings, bulkhead fittings, plugs, connectors, etc., required to field interface to the equipment and panels shall be provided by the supplier when the equipment is delivered.
- M. All electrical and instrumentation Drawings associated with the equipment shall be provided with the equipment when it is delivered to the job site. Drawings for each piece of equipment shall be placed in clear plastic packets of sufficient strength that will not tear or stretch from drawing removal and insertion.
- N. Vertical motors shall have conduit installed per drawing E35, Detail D. Horizontal motors shall have conduits installed per drawing E35, Detail B. All motors shall have make-up connections at motor per drawing E35, Detail C.
- O. All lugs shall be copper. No aluminum lugs shall be allowed.

3.03 EQUIPMENT FABRICATION, GENERAL

- A. Panel cutouts for devices (i.e., indicating lights, switches) shall be cut, punched, or drilled and smoothly finished with rounded edges. Exposed metal from cutouts that are made after the final paint finish has been applied shall be touched up with a matching paint prior to installing device. Do not paint nameplates, labels, tags, switches, receptacles, conductors, etc.
- B. All doors shall be fully gasketed with nonshrinkable, water and flame resistant material.
- C. Bolts and screws for mounting devices on doors shall be as specified by the manufacturer, otherwise they shall have a flush head which blends into the device or door surface. No bolt or screw holding nuts shall be used on the external surface of the door.
- D. No fastening devices shall project through the outer surfaces of equipment.

- E. Each component within the equipment shall be securely mounted on an interior subpanel or backpan and arranged for easy servicing, such that all adjustments and component removal can be accomplished without removing or disturbing other components. Mounting bolts and screws shall be front located for easy access and removal without special tools. Access behind the sub panel or backpan shall not be required for removing any component.
- F. A ground bus shall be provided in each enclosure or cabinet. It shall have provisions for connecting a minimum of ten grounding conductors. Screw type lugs shall be provided for connection of grounding conductors. All grounding conductors shall be sized as shown on plans or in accordance with NEC Table 250-122, whichever is larger.
- G. Minimum wire bending space at terminals and minimum width of wiring gutters shall comply with NEC Tables 373-6 (a) and (b).
- H. Wire sizes shall not be installed smaller than those shown in NEC Article 310 for each circuit amperage rating.
- I. Future device and component mounting space shall be provided on the door, backpan, and subpanel where detailed on the Drawings. Where no detail is shown, provide a minimum of 15 percent usable future space.
- J. Doors shall swing freely and close with proper alignment.
- K. All control, power, and signal wires inside enclosures shall be run in separate plastic wireways. Wireways shall not be filled over 50% capacity.

3.04 DELIVERY

- A. Contractor shall inspect each electrical and instrumentation item delivered to the jobsite.
- B. Contractor shall unpack each item for inspection within two (2) days of arrival.
- C. Complete written inventory shall be produced by Contractor and submitted to Government within (2) days after arrival on jobsite for record keeping prior to any payment for the item.

3.05 DAMAGED PRODUCTS

- A. Damage products will not be accepted. All damaged products shall be replaced with new products.

3.06 FASTENERS

- A. Fasteners for securing equipment to walls, floors, and the like shall be stainless steel. The minimum size fastener shall be 3/8-inch diameter. Layout to maintain headroom, neat mechanical appearance, and to support equipment loads required
- B. Anchor Methods:
 - 1. Hollow Masonry: Sleeve type anchors.
 - 2. Solid Masonry: Sleeve type anchors or epoxy anchors bolts.
 - 3. Metal Surfaces: Machine screws, bolts, or welded studs.

4. Concrete Surfaces: Wedge or expansion anchors.
 5. Structural Steel: Right angle, parallel and edge type rigid metal clamps. Do not weld or drill structural steel.
- C. Equipment Mounting:
1. The Contractor shall be responsible for furnishing and setting all anchor bolts required to install his equipment.
 2. Electrical equipment shall be unistrut "stand off" mounted a minimum of ½ - inch from the wall in a manner so that the rear of the equipment is freely exposed to air circulation. Unistrut material shall be stainless steel in NEMA 4X areas and galvanized in non-NEMA 4X areas unless called out specifically in details.
 3. All equipment enclosures shall be of the NEMA classification noted on the electrical plan Drawings for the area in which the device will be mounted.
 4. Reinforced concrete pad with stainless steel anchor bolts shall be provided for each electrical freestanding equipment.
- D. Dissimilar metals such as aluminum, stainless steel, steel, galvanized steel between enclosures, devices, etc. and mounting surfaces shall be isolated from each other using insulated tape or nonmetal spacers. Tape and spacers used shall be specifically manufactured for this application.

3.07 INSTALLATION, GENERAL

- A. System:
1. Install all products per manufacturer's recommendations and the Drawings.
 2. Provide relays, signal converters, isolators, boosters, and other miscellaneous devices as required.
 3. Change normally open contacts to normally closed contacts or visa versa.
 4. Adding additional relays to provide more contacts as necessary.
 5. Keep a copy of the manufacturer's installation instructions on the jobsite available for review at all times prior to and during the installation of the associated equipment.
- B. Panels and Enclosures:
1. Install panels and enclosures at the location shown on the Drawings or approved by the Engineer.
 2. Install level and plumb.
 3. Seal all enclosure openings to prevent entrance of insects and rodents.
 4. All conduits entering outdoor panels and enclosures shall use watertight hubs. These hubs shall be located on sides or bottom only. Top entry of outdoor panels or enclosures is not allowed.

5. Clearance about electrical equipment shall meet the minimum requirements of NEC 110-26
- C. Conduits and Ducts:
1. Install all conduits and ducts per Sections 16110, 16111, 16115 and 16190.
- D. Wiring, Grounding, and Shielding:
1. Wiring inside and outside equipment shall be installed per Section 16120.
 2. It is important to observe good grounding and shielding practices in the generally noisy environment in this application. The shield of shielded cables shall be terminated to ground at one end only, the receiving end. The shield at the other end shall be encased in an insulated material to isolate it from ground.
 3. Special cables shall be provided when required by manufacturer or necessary to correct noise or distortion interference at no additional cost to Government.
 4. Field wiring shall not begin until interconnection drawings have been submitted by the Contractor and approved by the Engineer, per Section 16011.
- E. Cutting and Patching:
1. The Contractor shall do all cutting and patching required to install his work. Any cutting which may impair the structure shall require prior approval by the Engineer. Cutting and patching shall be done only by skilled labor of the respective trades. All surfaces shall be restored to their original condition after cutting and patching.
- F. Seals:
1. Seal around all conduits, wires, and cables penetrating between walls, ceilings, and floors in all buildings with a fire stop material. Seal shall be made at both ends of the conduit with a fire stop putty. Seal shall have a minimum two hour rating. Fire stop sealing shall be International Protective Coatings Flamesafe, or approved equal.
 2. Seal around conduits entering outside to inside structures and around bottom of free standing enclosures to maintain watertight integrity of structure.
 3. Place conduit seal inside each underground conduit riser into panels and enclosures to prevent entrance of insects and rodents.
- G. Housekeeping Pads:
1. Concrete housekeeping pads are required for all free standing electrical equipment. Housekeeping pads shall be 3-1/2" inches above surrounding finished floor or grade unless otherwise shown and shall be 4 inches (minimum) larger in width on all sides of equipment. The depth of housekeeping pads shall be 18 inches (minimum).
 2. Housekeeping pads shall be installed for future units as shown on the Contract Drawings.

3. Housekeeping pad shall be Class "A" concrete with rebar crossway network. The minimum size rebar allowed is #3. Concrete shall be precisely leveled so that equipment set in place will not require shimming.

H. Cleaning and Touch up:

1. At the completion of the work prior to final acceptance, all parts of the installation, including all equipment, exposed conduit, devices, and fittings shall be cleaned and given touch up by Contractor as follows:
 - a. Remove all grease and metal cuttings.
 - b. Any discoloration or other damage to parts of the building, the finish, or the furnishings, shall be repaired.
 - c. Thoroughly clean any of his exposed work requiring same.
 - d. Vacuum and clean the inside of all MCC and electrical and instrumentation enclosures.
 - e. Clean all above and below ground pull boxes, junction boxes, and vaults from all foreign debris prior to final acceptance.
 - f. Paint all scratched or blemished surfaces with the necessary coats of quick drying paint to match adjacent color, texture, and thickness. This shall include all prime painted electrical equipment, including enclosures, panels, poles, boxes, devices, etc.

3.08 SAFETY LOCKOUTS

- A. Contractor shall provide safety lockout tags on the breakers for all MCCs and Panelboards and other electrical enclosures. Safety tags shall not be the same as those used by the Government. All padlocks used for this purpose shall be keyed differently from any of the Government's padlocks. Padlocks shall remain in place by the Contractor until operation of the portion of work is turned over to the Government with the responsibilities noted on the acceptance form. The following is the procedure for transferring each portion of work over to the Government prior to completion of the entire project:
1. Contractor shall inform the Government when a portion of the work is complete, ready for inspection and available to be placed into operation.
 - a. The Government will schedule the inspection and substantiate that the work is complete and operational.
 - b. The Contractor will correct any deficiencies.
 - c. The Government will prepare a Partial Utilization form in which that portion of the project will be turned over the Government with the responsibilities noted on the acceptance form. The Contractor then shall remove his safety lockouts and tags.
 - d. Safety lockout tags shall be rigid vinyl with write-on surface and brass grommet. Safety tags shall be secured in place with cord of sufficient

strength to prevent accidental removal or displacement. Lockout shall meet OSHA standard 1910.147 requirements.

3.09 TESTING

- A. Factory testing shall be as specified in Section 16610.
- B. Field Tests shall be as specified in Section 16620.

3.10 TRAINING

- A. Training shall be as specified in Section 16900.

3.11 SPARE PARTS

- A. Spare parts shall be provided as specified in Section 16013.

3.12 WARRANTY

- A. The Contractor shall warrant all electrical and instrumentation equipment and software programming supplied under this Division 16 for a period of one (1) year from date of final acceptance. Standard published warranties of equipment which exceed the preceding specified length of time shall be honored by the manufacturer or supplier.
- B. The Contractor shall provide all labor and material to troubleshoot, replace, or repair any hardware or software that fails or operates improperly during the warranty period, at no additional cost to the Government.
- C. The system supplier shall have a staff of experienced personnel available to provide service on a two (2) working day notice during the warranty period. Such personnel shall be capable of fully testing, programming and diagnosing the hardware and software delivered; and of implementing corrective measures.
- D. If the system supplier fails to respond in two (2) working days, the Government at its option will proceed to have the warranty work completed by other resources; the total cost for these other resources shall be reimbursed in full by the Contractor. The use of other resources, as stated above, shall not change or relieve the Contractor or supplier from fulfilling the remainder of the warranty requirements.
- E. Each time the System Supplier's repair person responds to a system malfunction during the warranty period, he or she must contact the designated Government maintenance supervisor for scheduling of the work, access to the jobsite, and permission to make repairs. Operation of facilities necessary to test equipment shall only be performed by or under the direction of the Government Staff. The Government reserves the right at its sole discretion to deny operations requested by the System Supplier. A written description of all warranty work performed shall be documented on a field service report to be given to Government prior to the repair person leaving job site each day. This field service report shall detail and clearly state problem, corrective actions taken, additional work that needs to be done, date, repair person name and company.
- F. Prior to "final acceptance", the Contractor shall furnish to the Engineer a listing of warranty information for all manufacturers of materials, instruments, and equipment used on the project. The listing shall include the following:

1. Manufacturer's name, service contact person, phone number, and address.
2. Material and equipment description, equipment number, part number, serial number, and model number.
3. Manufacturer's warranty expiration date.

3.13 FINAL ACCEPTANCE

- A. Final acceptance will be given by the Government after the equipment has passed the "final acceptance trial period", each deficiency has been corrected, final documentation has been provided, and all the requirements of design documents have been fulfilled.
- B. Upon completion of the project, prior to final acceptance, remove all temporary services, equipment, material, and wiring from the site.
- C. At the end of the project, following the completion of the field tests, and prior to final acceptance, the Supplier shall provide the following to the Government:
 1. A listing of warranty information.
 2. Each "operation and maintenance" manual shall be modified or supplemented by the Supplier to reflect all field changes and as-built conditions.
 3. Two (2) disk copies of all final documentation to reflect as-built conditions.
- D. Prior to final acceptance submit each key with matching duplicate. Wire all keys for each lock securely together. Tag and plainly mark with lock number or equipment identification, and indicate physical location, such as panel or switch number.

**** END OF SECTION ****

SECTION 16210

DIESEL GENERATOR

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. These specifications describe the minimum requirements for a skid mounted, standby duty, three phase turbocharged with aftercooler engine driven electric generator powered from Diesel fuel. A larger generator shall be supplied when necessary to meet the requirements of this section. Section 16210 Appendix "B" contains the "Generator Data Form" which lists the minimum sizing for the generator and accessories. The Contractor shall fill in form with proposed values and include this form with the generator submittal.
- B. The engine generator shall include a diesel engine, control and instrument panel, batteries, battery charger, brushless alternator, excitor, voltage regulator, generator main breaker, fuel tank, sub-base day tank, fuel pump, fuel tank, radiator, blower fan, exhaust silencer, vibration isolator, and special options as stated herein.
- C. The major areas in the scope of work includes providing for and installation of a complete standby power system:
 - 1. Standby Generator system.
 - 2. All aboveground piping associated with connecting fuel system.
 - 3. Intake/exhaust air system and ducts.
 - 4. Detached above-ground mounted fuel tank.
 - 5. Weatherproof/sound attenuating housing.
- D. Existing generator shall remain in service until District approved changeover to new generator. Periods where the plant will not have standby generator power shall be coordinated with District per Section 16010-1.08.E. Contractor shall submit generator change over plan to District for approval. Contractor is responsible for removing existing generator and delivering to District at El Dorado Hills WWTP, 4625 Latrobe Road, El Dorado Hills, CA 95623 per Contract Drawings.
- E. The engine generator shall be provided as described in the following specification.
- F. All auxiliary apparatus and accessories shall be provided, at no additional cost to the Government, as required for a fully functional engine generator.
- G. The engine generator shall be delivered as a skid mounted unit, piped and wired for operation.
- H. Provide the field installation, startup, testing and training for the engine generator and associated equipment as part of this scope of work.

- I. All equipment shall be new, of current production by a U.S. firm which manufactures and/or assembles the components of the engine generator as a matched unit so that there is one-source responsibility for warranty, parts, and service through a manufacturer's local representative.
- J. The manufacturer's local representative shall be an authorized distributor who maintains a stock of spare parts for the supplied engine generator and has a service facility with factory-trained service personnel. The manufacturer's local representative shall be located within a radius of 100 miles of the Government.
- K. The engine generator shall meet all local El Dorado County and Environmental Protection Agency (EPA) emission and noise requirements at final inspection. Provide all information, fill out forms (permit to construct and permit to operate) and obtain approval from the El Dorado County Air Pollution Control District (phone number (530) 621-6662).
- L. The diesel engine and generator shall be as manufactured by one of the three combinations of engine and generator manufacturer listed as follows:

	<u>ENGINE</u>	<u>GENERATOR</u>
1.	Detroit Diesel	Kohler
2.	Cummins	Onan
3.	Caterpillar	Caterpillar
- M. Unit shall meet all current Local, State and Federal emission requirements at time of installation.
- N. The diesel engine and generator shall be as manufactured by Kohler, Caterpillar, or approved equal by the Government.

1.02 SPECIFICATIONS

- A. The bidder shall examine carefully the specifications. It will be assumed that the bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality and quantities of work to be performed and materials to be furnished, and as to the requirements of these specifications and the contract. After the signing of the Contract, no consideration will be given to any claims of misunderstanding of the work to be done, or of any provisions of the specifications and contract documents.
- B. All equipment/options are to be factory installed. If the equipment/options are not available factory installed, dealer installed equipment/accessories may be acceptable. The Contractor is to specify those items which will be dealer installed in the submitted bid document.
- C. Only new models in current production, that meet the requirements of these specifications and which are cataloged by the manufacturer and for which manufacturer's published literature and printer specifications are currently available, will be considered. Special options may be included only when recommended by the manufacturer of the unit approved by the Government.

1.03 QUALIFICATION

- ~~A. Bids will be considered only on equipment represented by a reliable California firm carrying an adequate supply of repair parts in the State.~~
- ~~B. The Supplier shall have represented both the engine and generator manufacturers for at least three years prior to the bid award.~~

- ~~C.D. By entering into this contract, the Contractor shall guarantee the availability of service for this standby power system by the Contractor during the warranty period.~~

1.041.03 SUBMITTALS

- A. Submit six (6) sets of shop documents and drawings for approval in accordance with this subsection.
- B. Submit data sheets and catalog cuts for:
1. Engine:
 - a. Make and model
 - b. Number of cylinders and cylinder arrangement
 - c. Bore, Inches
 - d. Stroke, Inches
 - e. Compression ratio
 - f. Piston displacement, Cubic Inches
 - g. Piston speed, Feet per Minute, at rated RPM
 - h. HP at rated KW output
 - i. Rated RPM
 - j. Number and type of bearings
 - k. Fuel type and consumption at full load
 - l. Cylinder head material
 - m. Crankshaft material
 - n. Valves material
 - o. Governor type
 - p. Block heaters
 2. Generator:
 - a. Make and type
 - b. Generator full load electrical rating, KVA, KW, Voltage, Amperage, Hz, # of Phases, # of Wires, Power Factor
 - c. Peak motor starting, KVA
 - d. Number of leads
 - e. Number and type of bearings
 - f. Voltage regulator type
 - g. Exciter type
 - h. Generator winding insulation class and temperature rise
 - i. Generator transient (x'd) and subtransient (x'd) reactance in per unit
 - j. Frequency regulation, %, from no-load to full load
 - k. Frequency regulation, %, at steady state full load
 - l. Ambient temperature range
 - m. Voltage regulation from no load to full load
 3. Electrical:
 - a. Control and instrument panel
 - b. Batteries and battery charger
 4. Accessories:
 - a. Exhaust silencer, stack, and piping system

- b. Fuel tank and piping system
 - c. Vibration isolation system
 - d. Water Cooling system
 - e. Weatherproof/sound attenuating Housing.
- C. Submit electrical schematics and wiring diagrams for:
 - 1. Generator control panel
 - 2. Battery charging system
 - 3. Main generator
 - 4. Voltage regulator
 - 5. Governing system
 - 6. Weatherproof housing auxiliary electrical devices
- D. Submit dimension drawings for:
 - 1. Engine generator side, front, and top
 - 2. Generator skid construction and size, anchor details
 - 3. Exhaust muffler and air intake baffle
 - 4. Conduit stub-up areas under generator frame
 - 5. Weatherproof housing
- E. Submit reports, calculations, and curves in one three-ring binder for:
 - 1. Engine horsepower curves. These curves shall show the manufacturer's approval of the engine rating for standby application per the specifications stated herein.
 - 2. Engine generator fuel consumption curves.
 - 3. The Contractor shall submit seismic calculations for the proposed construction of the bolt tie-down to concrete pad to anchor the engine generator.
 - 4. Calculations showing that the unit meets the specified noise and emission requirements.
 - 5. Generator load report showing that the unit shall start the loads as specified in this section. Submit typed statement that the generator has been sized to operate the specified loads. Submit calculations and back-up to shown the generator is properly sized.
 - 6. Generator Switchgear Plan. The plan shall describe the Contractor's plan to transfer standby power from existing generator to new generator. Plan shall describe Contractor's contingency plan to ensure standby power to plant at all times. Contractor shall provide and have on site a 800KW 480V standby generator with fuel tank to provide 24 hours of runtime at 100% load prior switchover.
- F. Descriptive literature shall be provided that describes the engine generator and all accessories. This literature shall provide sufficient detail to determine that the engine generator has all the accessories, options, features, and characteristics specified herein. Items that are not provided shall be neatly lined out.
- G. The Contractor shall include in writing as part of the submittal details any proposed departures from the design documents, and the reasons therefore. Incorporate no such departures into the work without prior written approval of the Government. The approval of departures which

substantially deviate from the design documents shall be evidenced by a "change order" directive by the Government. Any cost differential associated with this change order must be negotiated with the Government to amend the scope of work to reflect the costs or savings.

- H. A copy of this specification section, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (Y) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore, requested by the Contractor, each deviation shall be underlined and denoted by a unique number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the Specifications. The submittal shall be accompanied by a detailed, written justification for each numbered item explaining variance or non-compliance with specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no review.
- I. The Contractor shall note that the named generator equipment, if given, is considered acceptable, but in some cases additional design, options, or modifications may be required, at no additional cost to the Government, to meet Specifications.
- J. The decision of the Government stipulates what is acceptable as an approved equal. If the Government considers it necessary, tests to determine equality of the proposed substitution shall be made, at the Contractor's expense, by an unbiased laboratory satisfactory to the Government. Equality will be judged on the basis of the following:
 - 1. Conformance with description or performance required.
 - 2. Equal in quality.
 - 3. Comparable in operation and maintenance.
 - 4. Equal in longevity and service under conditions of climate and usage for given application.
 - 5. Conformance with space allocations.
 - 6. Comparable in appearance and artistic effect.
 - 7. Compatible with mechanical and electrical construction of related work without necessitating changes in detail.
- K. No material or equipment shall be allowed to be delivered to the Government until the submittal for such items has been reviewed by the Government and approved.
- L. Each submittal shall be bound in a three ring binder, which is sized such that when all material is inserted the binder is not over $\frac{3}{4}$ full. Binder construction shall allow easy removal of any page without complete manual disassembly, spiral ring type binders are not acceptable. Each binder shall be appropriately labeled on the outside with the project name, job number, equipment Contractor's name, specification section(s), and major material contained therein. An index shall be provided at the front of all sections which itemizes the contents of each tab and subtab section and lists the project name, job number and equipment's Contractor's name, address, phone number, and contact person. Drawings that are "C" or "D" size shall be folded with the title block visible and placed in clear plastic pockets. FAXed documents shall not be used in any manuals.
- M. Submit complete and specific information with regard to equipment representatives and service facilities.

- N. The generator manufacturer (representative is not acceptable) shall submit and provide the following letters in the manufacturer's letterhead prior to shipment of generator from the factory:
1. Letter certifying that the manufacturer has reviewed the connected loads power and certifies that the generator to be provided shall start the loads, in any combination or sequence, without generator voltage dropping below any of the connected equipment ratings.
 2. Letter certifying that the manufacturer has contacted the primary pump and motor control center suppliers for this project to insure compatibility and proper coordination between the generator sizing and motor starting methods. Interaction between the generator and motor starting method shall not cause adverse effects to electronic devices and controls. This letter shall list each individual load by type, size, manufacturer, starting method and compatibility with generator.
 3. Letter shall state that the generator to be supplied was verified to be compatible, without any adverse effects with other major equipment to be supplied for this project. This letter shall state the name and manufacturer of primary pumps, automatic transfer switch and motor control center and contain proof of verification of compatibility.

1.051.04 MEASUREMENT AND PAYMENT

- A. The Contractor's bid shall include tax, licenses, freight, delivery expenses, fuel and other miscellaneous charges.
- B. Payment shall be per the following schedule:
1. 80% upon delivery and inventory of major components of standby power system, load bank, and fuel tank.
 2. An additional 10% on approval of "operation and maintenance" manuals specified herein.
 3. Balance of 10% upon final acceptance specified herein.

PART 2: PRODUCTS

2.01 QUALITY

- A. It is the intent of these design documents to secure an engine generator of the latest commercial design that has been prototype tested, factory built, production tested, site tested, as a total unit together with all accessories.
- B. All materials, components, and parts supplied shall be highest grade, unused, new, and in current production.
- C. Provide all of the features, options, and accessories specified herein.
- D. All rotating parts shall be guarded against accidental contact.
- E. Generator shall be rated for use with reduced voltage starters.

2.02 RATING

- A. The engine generator shall have a minimum continuous standby rating as listed in Section 16210 Appendix "B". Standby rated shall means that generator starts within 60 seconds upon being called to operate at continuous uninterrupted operation for the total duration of a power outage. Rating of the engine generator shall be based on operation when equipped with all necessary operating accessories such as radiator, fan, air cleaners, lubricating oil pump, governor, exhaust silencer, etc.
- B. The engine horsepower rating shall be a minimum HP/KW listed in Section 16210 Appendix "B".
- C. No derating from the ratings specified shall occur for ambient temperatures below 122°F or installation elevation below 500 feet.
- D. The engine generator will be installed at approximately 860 feet above sea level. The engine generator shall operate successfully at ambient temperatures between 20°F and 115°F.
- E. The engine/generator shall accept 100% of the nameplate KW rating in one step, in compliance with NFPA 110, Paragraph 5-13.2.6.
- F. The engine generator shall be capable of successfully providing three phase, 60 hertz power to start and continuously run loads listed on Contract Drawings. The maximum step voltage dip shall be 10%, below rated voltage as measured line to line at the generator terminals, during start of pump.

2.03 ENGINE

- A. The engine shall be an electronic ignition engine type, four cycle with vertical inline or V-type cylinders, turbocharged with aftercooler.
 - 1. The engine shall utilize only #2 diesel fuel.
 - 2. Piston displacement shall be the minimum cubic inches listed in Section 16210 Appendix "B".

3. The engine shall be of direct injection design i.e., pre-combustion chambers shall not be incorporated in the cylinder heads. Glow plugs shall not be used for engine starting
 4. The engine shall deliver the minimum HP listed in Section 16210 Appendix "B".
 5. The engine shall have sufficient power to produce the specified ratings when operating with all accessories including exhaust, fuel, cooling, and battery charging systems, etc.
- B. The engine shall be equipped with:
1. Engine driven or electric fuel transfer pump, fuel filters, electric fuel shutoff valve, flexible fuel line, and secondary fuel pressure regulator. The fuel transfer pump shall be capable of lifting the fuel from the above-ground fuel tank. The fuel filters shall be replaceable and conveniently located for servicing.
 2. Electrical governor; consisting of a magnetic pickup speed sensor, adjustable electronic control, and an electrical actuator mounted integrally with the fuel pump. The governor shall provide automatic engine generator set frequency regulation adjustable from isochronous to 5% droop. Governors using external throttle linkages are not acceptable.
 3. Positive engagement solenoid shift-starting VDC starter rated for amps cranking current as listed in Section 16210 Appendix "B".
 4. Battery charging alternator with a minimum ampere output as listed in Section 16210 Appendix "B".
 5. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain. The oil pump shall be capable of supplying adequate lubricating oil under pressure to the main bearings, crankshaft bearings, pistons, piston pins, timing gears, camshaft bearings, and valve rocker mechanism. The cartridge oil filters shall be full flow type, conveniently located for servicing. Filters shall be equipped with a spring loaded bypass valve to insure oil circulation if filters are clogged. Provide isolation valve and piping to exterior of generator frame for oil change maintenance.
 6. Dry type replaceable air cleaner elements. The dry-type air cleaner shall be equipped with a self-cleaning dust and water evacuator and a vacuum restriction gauge to indicate maximum allowable restriction of the air cleaner system according to the engine manufacturer's recommendations. The air cleaner elements shall be conveniently located for servicing.
 7. Unit mounted radiator, blower fan, water pump, and thermostat. The radiator with blower type fan shall be sized to maintain safe operation at 122° F ambient temperature. The engine cooling system shall be filled with a solution of 50/50 ethylene glycol/water antifreeze or equivalent as recommended by the manufacturer. Provide expansion tank in clear view from outside generator enclosure maintenance door.
 8. Removable type cylinder liners.
 9. Replaceable insert main bearings.
 10. Block heater sizing, listed in Section 16210 Appendix "B" for "hot" start of engine.

2.04 GENERATOR

- A. The generator alternator shall be brushless, with skewed stator with 2/3 pitch windings and amortisseur rotor windings skewed for smooth voltage waveform. The generator shall have the following features:
1. Self-ventilated cooling.
 2. Drip-proof housing construction.
 3. 105° C alternator temperature rating.
 4. Voltage regulation under load from no load to full load within +/- 0.5%.
 5. Random voltage variation for constant loads, from no load to 100% load shall not exceed +/-0.5% of its mean value.
 6. Frequency variation shall be isochronous under varying loads from no load to 100% load.
 7. Random frequency variation shall not exceed +/- 0.25% of its mean value from no load to full load.
 8. The insulation material shall meet the NEMA standard (MG1-22.40 and 16.40) for class H and be vacuum impregnated with epoxy varnish to be fungus resistant per MIL I-24092.
 9. The excitation system shall be of brushless construction controlled by a solid state voltage regulator with adjustable volts-per-hertz operation capable of maintaining voltage within +/- 2% at any constant load from 0 to 100% of rating. The regulator shall be sealed from the environment and isolated from the load to prevent tracking when connected to SCR (Soft Starter) or Diode (VFD) loads.
 10. Semi-flexible disc direct coupling to engine flywheel.
 11. Maintenance free bearings.
 12. Radio interference suppression to meet the BS.800 and VDE Class G and N standards.
 13. Telephone interference factor of less than 50 per NEMA MG1-22.43.
 14. AC voltage waveform total harmonic distortion of less than 5% total from no load to full load. Any individual harmonic shall have less than 3% THD.
- B. On starting each listed load, by method shown on Contract Drawings, the instantaneous voltage dip shall not exceed equipment ratings and shall recover to +/- 2% of rated voltage within one second.
- C. The generator shall be capable of sustaining at least 250% of rated current for at least 10 seconds under a 3 phase symmetrical short by inherent design or by the addition of an optional current boost system.

- D. The generator shall be capable of providing a minimum of KVA for motor starting and KW for continuous operation as listed in Section 16210 Appendix "B".

2.05 CONTROLLER AND INSTRUMENT PANEL

- A. Provide a generator-set mounted controller and instrument panel installed. The panel mounting shall be vibration isolated from the rest of the engine / generator set.
- B. The controller unit shall be of all solid state construction, except for relays used as alarm followers to provided dry contacts or in switching high current circuits. The controller shall utilize a microprocessor for logic control. All printed circuit boards shall be conformably coated and moisture proof. Circuitry shall be of plug-in design for quick replacement. The controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall be capable of operation from -40°C to 85°C .
- C. The controller shall include:
1. Fused DC control circuits.
 2. Complete two-wire start/stop control which shall operate on closure of a contact from a remotely located automatic transfer switch.
 3. Engine starter control for:
 - a. Speed sensing and a second independent starter motor disengagement systems to protect against the starter engaging with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.
 - b. Starting system designed for restarting in event of a false engine start, by permitting the engine to completely stop rotating before reengaging the starter.
 - c. Cranking cyler with 15 second ON and OFF cranking periods or as recommended by the manufacturer. Cranking shall cease upon engine starting and running. Two means of cranking termination shall be provided, on as a backup to the other. Failure to start after three cranking cycles shall shut down and lockout the engine, and visually indicate an over-crank shutdown on the indicator panel. Over-crank protection designed to open the cranking circuit after 75 seconds if the engine fails to start or as recommended by the manufacturer.
 - d. Circuitry and sensing devices for emergency shutdown of the engine on any occurrence of the following conditions:
 - 1) High coolant temperature.
 - 2) Low oil pressure.
 - 3) Over speed.
 - 4) Over-crank.
 - 5) Low coolant level.

- 6) Remote manual stop station.
 - 7) Shutdown shall be initially inhibited for a time delay period as necessary to allow the engine start for shutdown conditions 1, 2, and 5 or as recommended by the manufacturer.
 4. A dry contact, normally open, which closes when the generator is running shall be provided and brought out to terminals for remote from the unit status monitoring.
 5. Engine cool down timer factory set at five (5) minutes to permit unloaded running of the generator set after transfer of the load to normal.
 6. Three position (RUN-STOP-REMOTE) selector switch with two complete sets of spare normally open contacts for the "RUN" and "REMOTE" positions. In the RUN position the engine shall start and run regardless of the position of the remote starting contact. In the REMOTE position, the engine shall start when contacts in the remote control circuit close and stop five minutes after those contacts open. In the STOP position the engine shall not start even though the remote start contact closes. This position shall also provide for immediate engine shutdown in case of emergency. Reset of any fault lamp shall also be accomplished by putting the switch to the off position.
 7. Emergency Stop maintained pushbutton located at maximum 5 feet above grade.
- D. The instrument panel shall meet NFPA-110 Controller Accessories Requirements and shall include the following:
1. Indicating lights to signal:
 - a. System ready indication (green)
 - b. Pre-warning for low oil pressure (yellow)
 - c. Pre-warning for high coolant temperature (yellow)
 - d. Low oil pressure shutdown (red)
 - e. High coolant temperature shutdown (red)
 - f. Over-crank shutdown (red)
 - g. Over-speed shutdown (red)
 - h. RUN-STOP-REMOTE switch in STOP position indication (flashing red)
 - i. Low coolant temperature (yellow)
 - j. Low battery voltage (red)
 - k. Low fuel tank level (red)

- I. Alarms lights shall latch-in on occurrence of an alarm unit manually reset by an operator. A test button shall be provided for testing the operation of all the lights listed above. A follower dry contact (normally open which closes on an abnormal condition) shall be provided and brought out to terminals for remote from the unit status indication of a common trouble alarm which is activated on the occurrence of any alarm.
2. Alarm horn. A silencer switch shall be provided which allows/prevents the horn from sounding on alarms.
3. Voltmeter, 3½-inch, +/- 2% full scale accuracy.
4. Ammeter, 3½-inch, +/- 2% full scale accuracy.
5. Means to indicate whether dual range meters are on high or low scales.
6. Voltmeter/ammeter phase selector switch.
7. Direct reading pointer-type frequency meter, 3½-inch, +/- 2% full scale accuracy, 45 to 65 Hz scale.
8. Coolant temperature gauge, 2-inch DC meter, +/- 2% full scale accuracy.
9. Oil pressure gauge, 2-inch DC meter, +/- 2% full scale accuracy.
10. Battery voltage gauge, 2-inch DC meter, +/- 2% full scale accuracy.
11. Engine running time meter.
12. Voltage adjust rheostat, +/- 5% range.
13. Lights shall be installed to illuminate all gauges, meters, and controls on the instrument panel. These lights shall be powered by the engine batteries and activated with a switch located on the control panel.

2.06 ACCESSORIES

- A. The following engine generator accessories shall be provided and installed:
 1. Exhaust Silencers: Critical type silencers including flexible stainless steel exhaust piping and fittings properly sized and installed according to the manufacturer's recommendation. The silencer shall be coated with a high temperature aluminum carbo-zinc #11 coating system for temperature and rust resistance. Gasproof, seamless, stainless steel, flexible exhaust connector(s) ending in pipe thread or SAE flange shall be used. Silencers shall be Maxim M41-10, or approved equal. Support for exhaust silencer is not to be carried by the exhaust manifold.

2. Exhaust Stack Pipe

a. Description

- 1) The system will be comprised of a flexible coupling at turbocharger, piping to connect flexible coupling to silencers, piping to carry gases through a rain cap. The silencer, stack, and exhaust piping shall be sized to insure that measured exhaust back pressure does not exceed the manufacturer's minimum or maximum limitation.

b. Materials:

- 1) Contractor to furnish black steel extra strong weight discharge pipe conforming to ASTM A53 grade A or ASTM A120 for engine exhaust system.
- 2) Flexible metal connections for junctions between turbocharger, piping and silencer. Spring loaded galvanized rain cap at end of exhaust pipe.

c. Rain cap shall be stainless steel with adjustable counter weights.

3. Vibration isolation dampeners between the engine-generator and steel mounting skid. The engine-generator isolation shall be steel compression spring type, seismic rated with earthquake restraints in both lateral and vertical directions. In addition snubbers shall limit and cushion extreme excursions due to shocks encountered when the engine-generator is in transit. These snubbers may be in separate devices.

4. Batteries: Battery rack with tie down clamps, battery cables, and volt batteries all mounted to the engine/generator skid. The batteries shall be capable of delivering the cold-cranking amps required at zero degrees Fahrenheit per SAE Standard J-537. The batteries shall be sized to provide a minimum of cold-cranking amps at VDC listed in Section 16210 Appendix "B".

5. Battery Charger: A current limiting minimum ampere, at VDC as listed in Section 16210 Appendix "B", completely solid state battery charger to automatically recharge the starting batteries. The charger shall be a float and equalize type. The complete charger unit shall be U.L. listed. The charger shall be a stand alone unit to be located within the engine/generator housing. The charger shall be operational through an ambient temperature range of -40°F to 140°F. It shall include the following features:

a. Fused AC input and DC output overload and short circuit protection.

b. DC ammeter and voltmeter, 5% full scale accuracy, to indicate battery charging rate.

c. "Power on" lamp to indicate when the charger is powered.

d. Reverse polarity protection to prevent the charger from operating if improperly connected.

e. Charger circuitry protection from line or load voltage transients.

- f. Charger temperature compensation. The charger shall provide temperature compensation of -2 mv/°C per cell over the ambient temperature of -40°C up to 60°C. This shall automatically adjust the "float" and "equalize" voltage settings to prevent the batteries from overcharging at high temperature and under charging at low ambient temperatures.
 - g. DC voltage regulation +/- 1% from no load to full load and over AC input line variations of +/- 10%.
 - h. Automatic "high rate" constant current charge circuit with automatic switchover to a lower "equalize" constant voltage charging rate and finally to a "float" charging rate. When the batteries have lost charge and AC power is applied to the charger input, the charger shall operate in the "high rate" constant current mode until the batteries voltage rises to the preset "equalize" level. At the preset "equalize" level, the charger shall switch to the "equalize" constant voltage mode until the current required to maintain this voltage drops to 50% of the charger's high rate current. The charger shall now switch to the lower constant voltage "float" mode (fully charged batteries). The charger shall continue to operate in this mode until AC input power is lost or the current required to maintain the batteries at float voltage setting exceeds a preset amperage.
 - i. Current limiting. Current limiting circuitry shall be provided to prevent damage to the charger from being overloaded at low battery voltage such as occurs during short circuit conditions or during engine starter cranking.
 - j. Low battery voltage contact connected to the instrument panel light.
 - k. Provide "Battery Charge Fail" dry contact to be connected to PLC.
 - l. The battery charger shall be powered from 120 VAC.
6. Sound Attenuating Housing:
- a. This enclosure shall house the engine, generator, control and instrument panel, battery charger, and all accessories.
 - b. The enclosure shall have galvanized steel or aluminum construction, painted inside and out with 2 coats each of rust inhibiting primer and 2 coats of exterior rated enamel. Color to be standard color as normally supplied by generator manufacturer. The side and rear panels shall be removable for easy servicing.
 - c. Provide 2-inch urethane foam coating on interior of housing, or equal sound attenuating jacket.
 - d. All panels shall have lockable latches to prevent tampering and unauthorized entry.
 - e. Louvers shall be provided at generator and radiator ends to provide ample air flow to insure proper cooling, without having to remove side panels.
 - f. Pressure drops through the enclosure shall not exceed limits set by the manufacturer of the diesel-driven standby electric generator.

- g. The enclosure shall be free standing, attached to unit or resting on the concrete pad supporting the engine generator.
- h. The engine exhaust silencer shall be attached to the enclosure with vibration isolators and exhaust out of the top of enclosure.
- i. The enclosure including exhaust system shall be designed so that sound levels measured at closest fence line (100' maximum) face of the enclosure, 5 feet above ground level, shall not exceed 55 dB(A) when the engine generator is running with no load and full load at full speed.
- j. Enclosure to have the following auxiliary electrical devices mounted inside housing prewired to terminal blocks located in generator control panel via conduits:
 - 1) Intrusion alarm door switch on each enclosure door.
 - 2) GFI 20A receptacle.
 - 3) Two 80W fluorescent lights and light switch.
- k. A resettable line current sensing safeguard thermal-magnetic circuit breaker with inverse time versus current response shall be provided mounted to the engine/generator unit. This breaker shall have adjustable long time, short time instantaneous and ground fault settings to allow selective tripping of downstream fuses or circuit breakers under a fault condition. This breaker shall protect the generator from damage that could occur due to the generator's own high current capability. This breaker shall not automatically reset preventing restoration of voltage if maintenance is being performed. The breaker size shall be three-pole with interrupt KAIC and amps rating (maximum size listed in Section 16210 Appendix "B") to match the rating of the wiring and automatic transfer switch.
- l. Sub-base Day Tank
 - 1) 600 Gallon (minimum) sub-base Day tank shall be supplied with the following components:
 - a) 1/2 HP (minimum), 24VDC, thermally protected motor with a 2 gpm (minimum) self-priming, sized to accommodate engine fuel flow positive displacement rotary gear pump to supply fuel for a diesel engine. Pump shall be capable of lifting No. 2 diesel fuel 120' (minimum) between the main fuel tank and the day tank. Pump shall be powered from generator batteries.
 - b) Electric analog float gauge displaying fuel level.
 - c) Alarm indications on electronic control module (ECM):
 - i) High Fuel Level.
 - ii) Low Fuel Level.
 - iii) Critical Low Fuel.
 - iv) Fuel in Rupture Basin.

- v) ECM functional.
 - d) Three modes of Day Tank Operation: On, Off & Test.
 - e) Product line to generator.
 - f) Fuel flow and return meters between generator and sub base fuel tank to determine fuel consumption. Provide two fuel flowmeters rated for engine fuel consumption at 100% load and fuel monitoring system shall display engine hour meter, gallon per hour consumption and total gallons consumed. Flowmeter shall be per El Dorado County Air Pollution Control District.
 - g) Fuel Return line to main fuel tank.
 - h) 110% (minimum) rupture basin.
 - i) UL Listed.
7. Above-Ground Mounted Fuel Tank
- a. Fuel tanks shall be sized to provide fuel for a minimum run time of twenty-four (24) hours at full load with a minimum capacity of gallons listed in Appendix "B".
 - b. Fuel tank shall be provided with the following features:
 - 1) Steel double contained in a concrete vault. Containment chamber shall be sized to hold the primary tank fuel capacity in event of a leak.
 - 2) Rectangular steel, 3/16 inch (minimum) thick walls.
 - 3) 30 year warranty on primary tank.
 - 4) Steel primary tank and secondary containment shall be encased in reinforced concrete (3,000 psi at 28 days with 3% air entrapment), 2 hour fire rating, UL listed in accordance with UL Standard 142, with 6 inch supports integral with base of unit, that allows for visual inspection of leaks under tank.
 - 5) 30 mil geo-membrane polyethylene liner encapsulating the tank and 1/4: thick polystyrene foam layer installed between liner and tank. Capability of physical monitoring between primary and secondary containment.
 - 6) Vault shall have exterior protective epoxy coating and warning signs.
 - c. Fuel tank shall be provided with the following appurtenances:
 - 1) 6 inch emergency vent as required by NFPA 30.
 - 2) 2 inch by 8 foot vent riser with vent cap (side vent).

- 3) 4 inch iron and brass lockable fill cap.
 - 4) 4 foot gauge stick.
 - 5) Mechanical fuel tank level gage with red zone marked at 85 percent of tank capacity.
 - 6) Low and high fuel level switches rated to switch 120VAC. All switches shall be explosion proof. Low fuel tank level alarm indication shall be posted on generator control panel.
 - 7) One inch fuel oil supply and return connections.
 - 8) Tank shall be furnished with Zone 4 seismic restraints. Contractor shall furnish calculations as specified herein.
 - 9) A U.L. listed overfill/spill container having a capacity of not less than 5 gallons (18.9L) shall be provided for the tank fill connection. Spill container shall be noncombustible and shall be fixed to the tank and equipped with a manual drain valve that drains into the primary tank.
- d. Location of all tank connections shall be coordinated with engine-generator manufacturer to provide a complete fuel delivery system.
 - e. Rust proofing, epoxy coated interior of interior tank, interior of exterior tank and bottom of exterior tank.
 - f. Rust inhibiting primer on exterior of interior tank and exterior of exterior tank.
 - g. Level Transmitter: The float level transmitter shall be a 420 mA linear transmitting device proportional to the level. Float, stem and mounting material shall be stainless steel suitable for this application. Power supply for transmitter to be 24VDC. Level transmitter shall be Gems XT-800 series or approved equal
 - h. The fuel tank shall not be filled in excess of 90 percent of its capacity. An overfill prevention system shall be provided for the tank. During tank filling operation, the system shall:
 - 1) Provide an independent means of notifying the person filling the tank that the fluid level has reached 85 percent of tank capacity by providing a tank level gage marked at 85 percent of tank capacity.
 - 2) Visual and audible operator notification when the quantity of liquid in the tank reaches 90 percent of tank capacity by high level switch.
 - 3) Automatically shut off the flow of fuel to the tank when the quantity of liquid in the tank reaches 90 percent of tank capacity. For rigid hose fuel-delivery systems, an approved means shall be provided to empty the fill hose into the tank after the automatic shutoff device is activated.
 - i. A permanent sign shall be provided at the fill point for the tank documenting the filling procedure and the tank calibration chart. The filling procedure shall

require the person filling the tank to determine the gallonage required to fill it to 90 percent of capacity before commencing the fill operation.

- j. Fuel tank shall be ConVault, Trusco or approved equal.

PART 3: EXECUTION

3.01 GENERAL

- A. The engine generator shall not be delivered to the job site until the certified factory test report as specified under testing has been reviewed and accepted by the Government. Missing or non-reviewed certified factory test report shall be sufficient cause for the unit to be rejected.
- B. The Government reserves the right at any time to reject any equipment that is not in conformance with design specifications.
- C. Rejected equipment shall be immediately removed from the delivery jobsite by the Contractor.

3.02 CONSTRUCTION METHODS

- A. The construction methods specified herein shall be followed by the manufacturer of the engine generator. If the manufacturer fails to comply then the Contractor shall pay all costs required to make the changes to the equipment to conform with these construction methods.
- B. Screw type solderless terminals or lugs shall be provided for connecting all external line and load power cables, control and instrument wiring. All connections shall be accessible from the front without removal of internal components.
- C. A terminal strip shall be provided for terminating all control and instrument wiring. Number all terminals with machine printed lettering matching the wire number of the terminated wire.
- D. All control and instrument wiring shall have permanent identification at each point of connection. Wire identification shall be by machine printed numbered wiring sleeves. Electrically common wires shall have the same wire number. Electrically different wiring shall have unique wire numbers.
- E. Control and instrument wiring shall be neatly bundled and secured in place by plastic cable ties. Wiring shall be protected with plastic spiral wrap where it is subject to mechanical damage or crosses over to a hinged door.
- F. Each instrument panel mounted device shall be identified with engraved 2-color black bakelite nameplates. The legends shall clearly identify each device function, avoiding the use of abbreviations. All nameplates shall be secured with stainless steel screws.
- G. Workmanship: The equipment and any accessories shall be a product of good workmanship and shall be free from any defects that will affect their appearance or serviceability.

3.03 FACTORY INSPECTION AND TESTS

- A. Factory Inspection: Prior to delivery to the Government, the Contractor shall notify and give the Government the opportunity to inspect and witness factory test of the completed engine generator assembly at the supplier's location. A written notice shall be given to the Government 7 days prior to the date for the factory test. Government costs to attend factory inspection and test will be paid by the Government, if the Government elects to attend. The engine generator shall not be shipped from the supplier to the Government without acceptance of factory test report and written authorization from the Government.

- B. Factory Tests: The engine generator to be supplied shall be tested by the manufacturer prior to shipment. All tests shall be made with all accessories installed. The factory tests shall be made under varying loads for a minimum of four hours total.
1. The factory testing shall include the following tests:
 2. Single step load pickup.
 3. Transient and steady state governing.
 4. Safety shutdown device testing.
 5. Voltage regulation.
 6. Rated power.
 7. Maximum power.
- C. A public notary certified typewritten factory test report shall be provided which lists the factory tests performed, results of the each test, name and phone number of person who performed the tests, date(s) of when tests were performed, serial and part number of equipment tested, all adjustment or setting values, and failures encountered and repairs made during testing. The factory test report shall be submitted to the Government for review and approval prior to shipment of any equipment. A Factory Generator Test Report as shown on sheet TFG1 in Section 16210 Appendix "A" shall be completed by Contractor and submitted to the Government for review and approval prior to shipment of any generator equipment.

3.04 INSTALLATION

- A. Battery Mounting: Mount batteries on steel battery rack attached to generator skid in a clean, dry location protected from falling hazards, but accessible to permit ease of inspection of electrolyte level. Provide and install a 2-pole padlockable-knife or keyed switch adjacent to batteries that will disconnect both the positive and negative leads of the batteries that feed all the generator circuits.
- B. Install condensation drain in exhaust piping and weather hood at end of exhaust for each engine generator.
- C. Equip all fuel lines with manual and automatic shutoff valves.
- D. Base: Mount engine, generator and radiator on a common structural steel sub-base capable of maintaining unit alignment suitable for mounting unit on a concrete foundation. Equip with vibration isolators between generator set and sub-base.
- E. Mount generator and load bank breakers, battery charger, batteries, heater and control panel to generator set unit.
- F. Ground generator neutral to ground per generator manufacturer's instructions.

3.05 FIELD TESTS

- A. The Contractor shall take all precautions necessary to ensure the safety of all personnel during the tests. Absolutely no tests shall be ran that could potentially cause injury or jeopardize personnel safety.
- B. The initial setup of the engine generator shall be performed by a factory-trained service person of the manufacturer's local representative. The factory-trained service person shall furnish and fill the engine fuel, lubricants, and cooling system. The factory-trained service person shall make all preliminary tests and checks required before engine start-up the day prior to witness field testing.

- C. The Contractor shall pay for a factory-trained service representative to perform one (1) 8-hour day of field tests, beginning at 8:00 a.m. any weekday, except Monday or Friday.
- D. Each failure mode, alarm, and control function shall be demonstrated by the Contractor's factory-trained service representative prior to performing any other field load tests.
- E. The following Generator Field Checklist shall be filled out by the generator manufacturer and given to the Government at the end of the field tests.
- F. Each item on the Generator Field Test Checklist sheet shall be marked with a check (Y) or "N/A" (not-applicable).

CHECKLIST

The Following (minimum) Installation Checks Must Be Made by Service Representative Before Start-Up in addition to those recommended by Generator manufacturer:

NOTE

This form is to be used as a general guide, follow the manual supplied with generator along with reference to any applicable codes or standards. Ultimate compliance must be with applicable generator manual and codes and standards.

- ___ 1. Equipment installed in dedicated room?
- ___ 2. Battery-powered emergency lighting installed in equipment room?
- ___ 3. Adequate clearance on all sides to allow ease of maintenance?
- ___ 4. Proper construction and leveling of mounting bases?
- ___ 5. Adequate heating for equipment room?
- ___ 6. Adequate incoming and outgoing air (louver motors adjusted and of proper voltage)?
- ___ 7. Radiator duct flange properly sized and connected?
- ___ 8. Cooling system properly filled?
- ___ 9. Proper level of specified oil in crankcase?
- ___ 10. Adequate/dedicated fuel supply?
- ___ 11. Flexible sections installed in cooling water lines?
- ___ 12. Manually-operable fuel and cooling water valves installed, allowing manual operation of, or bypass of solenoid valves, when used?
- ___ 13. Flexible fuel lines installed between engine and fuel piping?
- ___ 14. Fuel tanks and piping installed in accordance with applicable codes and standards?
- ___ 15. Adequate fuel transfer tank pump lift and pump motor properly wired?
- ___ 16. Proper size exhaust line and flexible connector(s)? Flexible connector(s) should not be bent.
- ___ 17. Exhaust line condensate trap with drain installed?
- ___ 18. Exhaust line installed with proper downward outgoing incline?
- ___ 19. Proper-specified muffler installed with hangers and mounts tight?
- ___ 20. Exhaust line free of excessive bends and restrictions? Back pressure under specified limit?
- ___ 21. Exhaust line protected from entry by rain, snow, and animals?

- ___ 22. Approved heat-isolating thimble(s) installed at points where exhaust line passes through combustible wall(s) or partition(s)?
- ___ 23. Exhaust system termination located to prevent entry of exhaust gases into structures?
- ___ 24. Battery(ies) of proper size and voltage?
- ___ 25. Battery(ies) filled with electrolyte and properly connected to charger?
- ___ 26. Battery charger AC circuit properly connected and charger operational?
- ___ 27. Battery(ies) properly mounted with adequate ventilation?
- ___ 28. Starting cables of proper length and gauge?
- ___ 29. Battery isolation disconnect knife switch installed?
- ___ 30. Starting cables properly connected to battery(ies)?
- ___ 31. Generator load conductors of proper ampacity, and properly connected to circuit breakers, and/or emergency side of transfer switch?
- ___ 32. Load conductors, engine start leads, battery and heater power source leads installed in separate conduits?
- ___ 33. Nameplate voltage and frequency of both generator set and transfer switch matching normal/utility source ratings?
- ___ 34. Transfer switch AC conductors properly connected (Normal to NL1, NL2, NL3; Emergency to EL1, EL2, EL3; Load to LL1, LL2, LL3)?
- ___ 35. Transfer switch switching mechanism free from binding? NOTE: Disconnect all AC sources, and operate manually to check.
- ___ 36. All other wiring, including customer added options, connected properly?
- ___ 37. Equipment room clean with all material not related to Generator Supply System operation removed?
- ___ 38. Earthquake rated anchoring adequate for equipment and support systems?

Tested by: _____

Witnessed by: _____

Date of Test: _____

- G. Each engine generator shall be tested with load bank supplied by Generator supplier under full load for four (4) continuous hours. The factory-trained service person shall be responsible for running the engine generator during these load tests. Any defects or failures discovered during these tests shall be corrected or adjusted by the factory-trained service person. The engine generator load test shall be restarted after each repair or adjustment that required shutdown of the engine generator as many times as necessary until the complete engine generator runs under full load without shutdown or failure for four (4) continuous hours.
1. Portable load bank shall be set-up the day before the start of the generator load bank testing.
 2. A resistive load shall be applied for the full-load test. The load bank is to provide a load equal to 100 percent of the generator nameplate kW. Unity power factor is acceptable for on-site testing, provided that rated load tests at rated power factor have been performed by the manufacturer of the generator at factory test prior to shipment.
 3. The full-load test shall be initiated immediately upon reaching rated rpm, pick up percent of nameplate kW rating on one step, less applicable derating factors for site conditions.
 4. Record the data listed on Field Generator Report Test Form TFG2 in Section 16210 Appendix "A" at first load acceptance and every 15 minutes thereafter until the completion of the four hour test period.

3.06 TRAINING

- A. The local representative's factory-trained service person shall instruct the Government's personnel in the proper operating and maintenance procedures for all components of the engine generator. This instruction shall be given for a minimum length of six (6) hours and on a date acceptable to the Government's schedule. Two hours of the training shall cover "operation" and four hours of the training shall cover "maintenance". Training shall not be given until the Government has received and approved the operation and maintenance manuals and field generator tests have been completed.

3.07 SPARE PARTS

- A. The Contractor shall supply sufficient spare parts to support the engine generator throughout the warranty period.
- B. The following spare parts shall be provided to the Government for each generator:
1. 12 each of each type and size of fuse.
 2. 12 each fuel filters for each type.
 3. 12 each oil filters for each type.
 4. 4 each air filters for each type.
 5. 24 spare lamps for each type.
- C. Spare parts shall be packaged for safe shipping and storage and clearly labeled on the outside with part name and number.

3.08 OPERATION AND MAINTENANCE MANUALS

- A. Prior to the delivery of the equipment, the Contractor shall submit six (6) sets of "operation and maintenance" (O & M) manuals for approval. O&M manuals shall be per this subsection.
- B. At least one of these sets of O & M manuals shall be made up of "original" (no copies or reproductions) documents.
- C. Manufacturer's or Contractor's standard brochures or manuals shall be edited to reflect only that model or series of equipment installed on this project, including any modifications. All extraneous material shall be crossed out or otherwise removed in a manner acceptable to the Government. All text, tables, graphs, and drawings shall be clear and legible. Black and white copies of color originals are not acceptable. Color originals or true color copies of these originals shall be provided in each set.
- D. All information required herein shall be provided even though it may be considered proprietary. If any of the information herein is considered proprietary, the Government will enter into a proprietary agreement with the Contractor. This agreement will stipulate that all such information will be kept confidential by the Government and the Government will use the information only for its internal use and will not reproduce any proprietary information for distribution.
- E. O & M manuals shall be contain the following:
 - 1. All submittal documentation required under this section with all corrections and changes made to reflect final as-built conditions.
 - 2. Operation, maintenance, troubleshooting, instruction, calibration, user, and other manuals available for "equipment" from the manufacturer. Subtab and index the different manuals for easy location.
 - 3. These manuals shall include or be amended to include the following:
 - a. An itemized list of all data provided.
 - b. Name and location of the manufacturer, the manufacturer's nearest distributor and spare parts warehouse.
 - c. Recommended installation, adjustment, modes of operation, startup, calibration, and troubleshooting procedures.
 - d. Warnings and cautions to prevent equipment damage and to insure personnel safety.
 - e. Complete internal wiring, component layout, connection, and schematic diagrams. All "proprietary" diagrams shall be included.
 - f. Complete parts lists, by generic title and identification number, cross-referenced to component layout diagram.
 - g. Disassembly and assembly instructions.
 - h. Recommended preventive maintenance procedures and schedule.

- i. Recommended lubrication and an estimated quantity for a year duration.
- j. Recommended spare parts list, including the unit price of each. The Contractor shall provide an availability policy listing the location of where spare parts are stocked and the delivery time for each of the recommended spare parts.
- k. All test data and test forms completed for this project.

3.09 WARRANTY

- A. The Contractor shall have a staff of experienced personnel available to provide service on two (2) working days notice during the warranty period. Such personnel shall be capable of fully testing and diagnosing the equipment delivered; and of implementing corrective measures.
- B. If the Contractor fails to respond in two (2) working days, the Government at its option will proceed to have the warranty work completed by other resources; the total cost for these other resources shall be reimbursed in full by the Contractor. The use of other resources, as stated above, shall not change or relieve the Contractor from fulfilling the remainder of the warranty requirements.
- C. Prior to final acceptance, the Contractor shall furnish to the Government a listing of warranty information for all manufacturers of materials and equipment supplied under the scope of work covered in these design documents. The listing shall include the following:
 - 1. Manufacturer's name, service contact person, phone number, and address.
 - 2. Material and equipment description, equipment number, part number, serial number, and model number.
 - 3. Warranty expiration date.
- D. Hardware Support:
 - 1. The Contractor shall warrant all equipment for a period of one (1) year from date of final acceptance. Standard published warranties of equipment which exceed the preceding specified length of time shall be honored by the manufacturer.
 - 2. The Contractor shall provide all labor and material to replace or repair any hardware that fails during the warranty period, at no additional cost to the Government.
 - 3. Free technical phone support on equipment for a period of one year. Support shall be provided directly from the manufacturer. Phone support shall be available between 8 a.m. and 5 p.m. California time, Monday through Friday.
- E. Each time the Contractor's repair person responds to a system malfunction during the warranty period, he or she must contact the designated Government maintenance supervisor for scheduling of the work, access to the jobsite, and permission to make repairs. Operation of facilities necessary to test equipment shall only be performed by or under the direction Government staff. The Government reserves the right at its sole discretion to deny operations requested by the Contractor.

3.10 FINAL ACCEPTANCE

- A. Final acceptance will be given by the Government after the equipment has been field tested satisfactorily, each deficiency has been corrected, documentation has been provided, and all the requirements of this Specification Section have been fulfilled.
- B. At the end of the project, following the completion of the field tests, and prior to final acceptance, the Contractor shall provide the following to the Government:
 - 1. Each "operation and maintenance" manual shall be modified or supplemented by the Contractor to reflect all field changes and as-built conditions. Reports of the factory and field tests are to be inserted into O&M manuals by Contractor.
 - 2. Manufacturer's field representative shall furnish a letter of compliance for the engine generator stating that the generator:
 - a. Has been properly installed and lubricated.
 - b. Is in accurate alignment and all leaks fixed.
 - c. Has been operated satisfactorily under full-load conditions and all tests have been completed.
 - d. Personnel trained in all operations.
 - e. Electrical system is completely corrected and properly functioning.
 - f. Ready for Government's usage as a standby generator.
 - g. Generator unit cleaned, touchup painted, and two sets of keys for all locks turned over to Government.
 - h. Punch list items have been corrected.

APPENDIX "A"

GENERATOR TEST FORMS

Index:

TFG1 Factory Generator Test Report

TFG2 Field Generator Test Report

APPENDIX "B"

GENERATOR DATA FORM

**** END OF SECTION****